SCIENTIFIC AMERICAN

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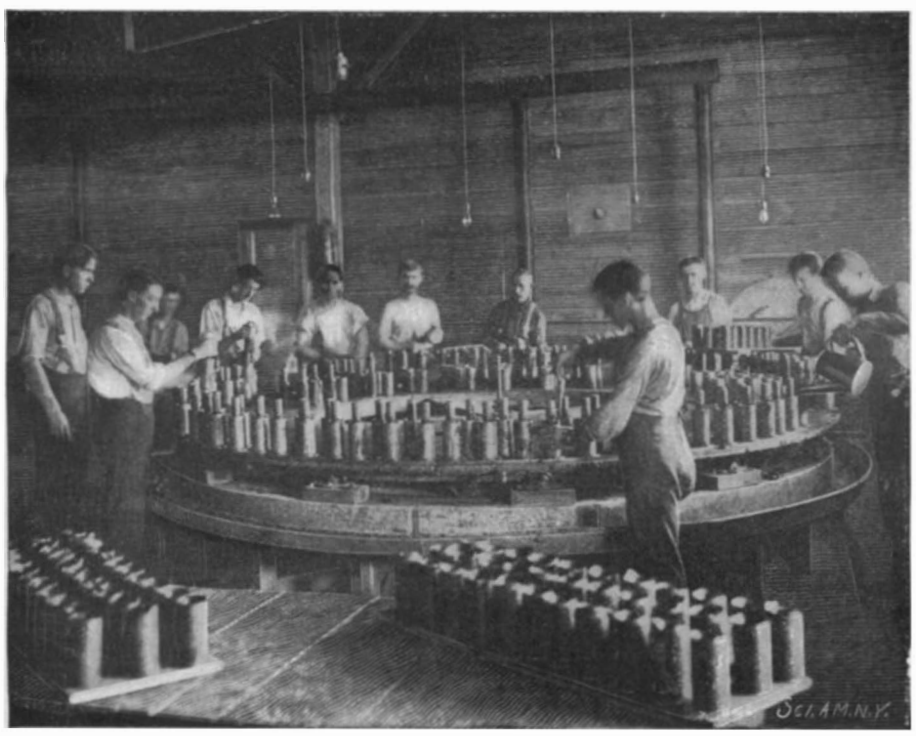


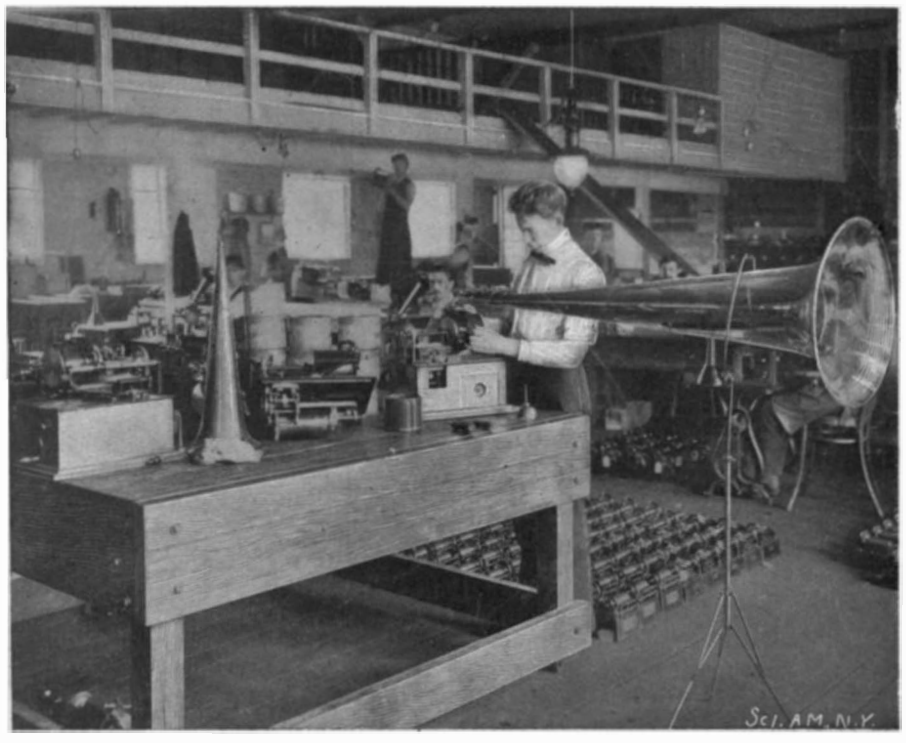
Casting Blank Records.

Turning the Blanks

Making Band Records.

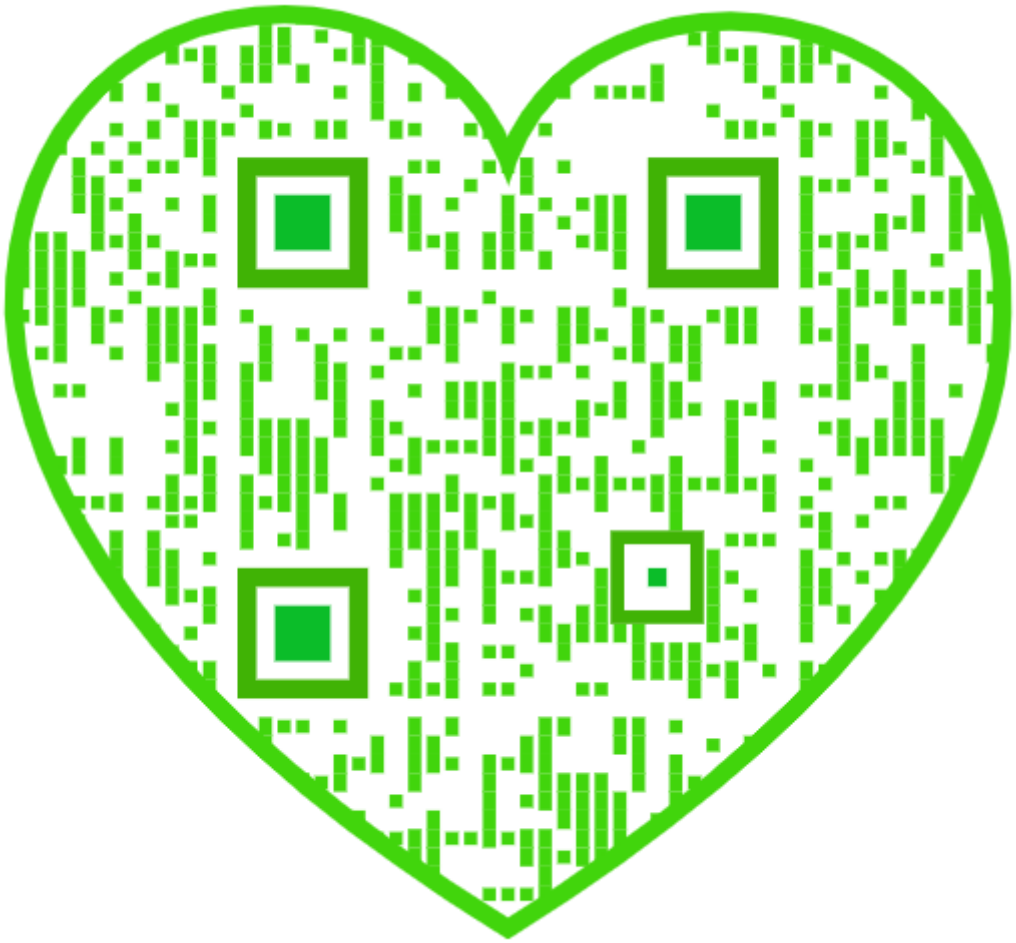
Making Violin Solo Records.

Testing the Records.



Testing the Phonographs.

THE MANUFACTURE OF EDISON PHONOGRAPH RECORDS.—[See page 800.]



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NEW YORK, SATURDAY, DECEMBER 22, 1900.

THE METRIC SYSTEM IN CONGRESS.

Now that the House Committee in charge of the bill to substitute the metric system in place of our present system of weights and measures has decided to make a favorable report, the chances of our having to think and talk in terms of meters and kilogrammes become very real. The arguments in favor of the metric system are so many, so reasonable, and so well known, that it is not necessary to reiterate them now. Apart from the saving of time and labor among ourselves, there is the commercial advantage which will be gained by abolishing a system of weights and measures which seriously hampers us in our trade with almost all the foreign nations, and particularly with the Latin-American republics. The English-speaking races stand alone in the use of the old and largely discredited system; and although these races are far in the lead in manufacture and commerce, and have the power, if they wish, to perpetuate for many a decade to come a confessedly clumsy and antiquated system, every argument of utility and convenience calls for the substitution of a decimal system, which, by long use, has proved its all-round superiority.

It is scarcely likely, however, that such a change will be made during the present Congress, and the probability of the bill's becoming a law would be greatly increased if the other great branch of the English-speaking race could be induced to make the change simultaneously with this country. The agitation in favor of the metric system is as strong, possibly stronger, in Great Britain than it is here, and in view of the close trade relations and the enormous volume of business between the two countries, it is well worth considering whether an attempt at concerted, or rather simultaneous, adoption of the metric system would not be advisable.

BOSTON AND THE "AMERICA" CUP.

Every one who is interested in the coming "America" cup contest was pleased to learn that Boston is to be represented in the races of 1901, for it was in this city that the celebrated Burgess boats were conceived and built, and it was to the generosity and sportsmanship of a Boston yachtsman that we owed that splendid trio of sloops "Puritan," "Mayflower," and "Volunteer," which, with the "Vigilant," were the last of the centerboards to maintain American traditions against the keel boats from over the ocean. We are glad to note that the gentlemen who will manage both the New York and the Boston yachts have intimated that they will be prepared to give to the public such information regarding the design and general characteristics of the yachts as may be made public without prejudicing the safety of the "America" cup. The announcement will be immensely popular with the public; for it is a fact that most of the secrecy which has marked the preparations for the contests of recent years was, as the disclosure of the models subsequently proved, quite unnecessary. When "Columbia" was taken out of the water, she proved to be merely a modified "Defender;" and "Shamrock," with the exception of her aluminum deck, possessed even less novelty of design and construction than "Columbia."

FILTRATION OF OUR WATER SUPPLY.

Sudden and extremely heavy rains of a few weeks ago, coming after a period of rather long drought, brought down into the storage basin of the Croton watershed a large amount of decaying vegetation and various forms of organic debris, which had lain comparatively undisturbed during the summer and autumn months. As seen in New York, the result was such a turbid and malodorous condition of the water, that not even the most earnest assurances on the part of the officials that there were no typhoid or other disease-producing germs in the water, could render it palatable. The public may be at times unreasonable, but it can scarcely be called so when it asks that pure water shall look pure, and that its qualities shall be something more than negative. Inasmuch as the Grand Jury has taken in hand the question of a better water supply for Greater New York, the present outcry comes at an opportune time.

Obviously the remedy is the provision of a first-class filtration plant, and the success which has attended filtration, notably in the case of Albany, is a guarantee that the outlay, though it might amount to several million dollars, would be money well spent. The report of the Merchants' Association Commission for the enlargement of New York's water supply, contemplates the erection of a vast filtration plant in the hills above Poughkeepsie, through which every gallon of water that comes to the city would pass. The construction of a filtration plant in connection with the Croton watershed would not be money thrown away, as provision might be made to incorporate it as a part of the larger scheme whenever the latter shall be carried through.

IMPORTS AND EXPORTS OF THE COUNTRIES OF THE WORLD COMPARED.

The Treasury Department is preparing a statistical abstract which will show the imports and exports of every country in the world which has statistical reports. In doing this, the aim of the Bureau of Statistics is decidedly ambitious, since it is intended to present a comparative picture of the world's commerce, not only of to-day, but for a long term of years extending into the past. The opening chapter of the proposed volume shows the imports and exports from the earliest date for which figures are obtainable, down to the present time. In the case of Great Britain, the report begins with the year 1800; of France, in the year 1831; and of Germany, in 1872. As far as the work has gone, the figures that show the total commerce, country by country, afford material for some interesting comparisons with our own growth. The imports for home consumption of Great Britain, for instance, which in the year 1800 amounted to $81,310,000, had risen in 1899 to $2,043,896,450, an increase of 2,400 per cent, while in the case of the United States the imports for home consumption, which in 1800 were $52,121,891, in 1899 had grown to $685,441,892, an increase of 1,215 per cent. The contrast on the export side of the comparison is much more clearly in favor of the United States; for while the exports of articles of home production from the United Kingdom in 1800 were $111,107,000, in 1899 they were $1,287,151,345, an increase of 1,059 per cent; whereas in the case of the United States the exports of home products rose from $31,840,903 in 1800 to $1,293,931,222 in 1899, an increase of 3,681 per cent.

As regards France, the comparison is equally interesting. In 1831 the imports for home consumption into France were $72,182,000, and they had increased 1,108 per cent by the year 1899, as against an increase during the same period in the case of the United States of 734 per cent. During the same period the exports of articles of home products in France showed an increase of 810 per cent, whereas the increase in the exports of the articles of home production in the United States during the same period was 1,933 per cent. Compared with Germany in the period from 1872 to 1899, while the German imports showed an increase of 64 per cent and the exports an increase of 42 per cent, during the same period the imports into the United States showed an increase of 24 per cent, and the exports of home products an increase of 181 per cent. A specially interesting fact developed by the study of these figures is that in the case of the United States they show with much greater frequency than in any other countries a favorable "balance of trade," or excess of exports over imports.

REPORT OF THE CHIEF OF THE BUREAU OF ORDNANCE.

The report of Rear-Admiral O'Neil, Chief of the Bureau of Ordnance, states that satisfactory progress has been made in the manufacture of the new long-caliber guns with which our latest battleships and cruisers are being armed; it also shows that the important work of converting the old slow-firing weapons to rapid-fire guns is being carried through as fast as the capacity of the gun shop at Washington will allow.

During the year the last of the 13-inch guns ordered, making thirty-four in all of that caliber, has been completed, while of the twenty 12 inch guns of the new 40-caliber pattern ordered for the ships of the "Maine" and "Arkansas" class, one has been tested at the proving grounds and has given admirable results. The test showed that this weapon is the most powerful of its type in the world, for under a powder chamber pressure of only 16½ tons, a velocity of 2,854 feet per second was developed, with an equivalent muzzle energy of 47 994 foot-tons. The power of this gun is shown by comparison with the 12-inch gun of the "Iowa," which with brown powder has a muzzle velocity of 2,100 foot-seconds and a muzzle energy of only 26,000 foot-tons; or with the 13-inch gun of the "Kearsarge," which with smokeless powder develops an energy of some 2,000 or 3,000 foot-tons less than the new weapon. Our new ships of the "Maine" and all later types will unquestionably be armed with the most powerful 12-inch rifle in the world.

EIGHT-INCH GUN.—The mention in the report of the 8-inch nickel-steel gun, 35 calibers long, which has been fitted with a new conical breech mechanism, calls to mind the late lamented Lieutenant F. J. Haesler, who, like the late Lieutenant Dashiell, was one of the most promising of our younger ordnance officers. The breech mechanism of the 8-inch gun mentioned was designed by the former officer. The threads of the plug are continuous and wind about a conical breech block. There are no slotted-out spaces, as in the cylindrical block, and its conical form enables the block to be swung on its hinge immediately into position, a single pull of the lever closing the block, turning the plug 225°, and engaging the thread throughout its whole length. Remarkable results for velocity of fire were shown by this gun at its trial. Beginning with the gun loaded, a rate of fire was obtained of six unaimed shots per minute.

SEVEN-INCH GUN.—We note with satisfaction that a set of forgings for a 7-inch experimental gun of 45 calibers has been delivered at the naval gun factory. The call for a gun intermediate in weight and power between the 8-inch and the 6-inch is occasioned by the wonderful improvement in armor due to the introduction of the Krupp process. Time was when the 6-inch gun was more than a match for the light armor carried by the cruiser class; but to-day it is questionable whether the 6-inch shell, even when fired from guns of the highest velocity, will have, at the ordinary fighting ranges, sufficient penetrative power to get through the Krupp plates of the modern cruiser. The 7-inch or 7½-inch gun combines something of the penetrative power of the 8-inch with much of the handiness of the 6-inch weapon, and we confidently look to see it adopted as one of the standard guns of the navy.

SIX-INCH GUNS.—An experimental 6-inch gun of 46 calibers has been tested, and with a chamber pressure of half a ton more than the 12-inch gun, or 17 tons to the inch, has developed a muzzle velocity of over 3,000 feet per second. The new guns of the battleship "Maine" and all later ships are to be 50 calibers long, and this increased length will no doubt enable them to secure the same velocity with a chamber pressure considerably below the specified regulation pressure. These results are, if anything, more creditable than those achieved with the 12-inch gun; for the muzzle energy corresponding to 3,000 foot-seconds is over 6,000 foot-tons. The muzzle energy of our early 6-inch guns is only 2,773 foot-tons, so that the introduction of its own special powder and improved methods of construction have enabled our Ordnance Bureau to more than double the striking energy of this caliber of weapon.

Good progress has been made with the new 50-caliber guns of 5-inch, 4-inch, and 3 inch caliber, and the present indications are that the armament of the many new vessels under construction will keep pace with the progress of the ships themselves.

A most valuable work of reconstruction, of which but little is known, is the task of converting the old slow-firing guns of the earlier ships of our navy to rapid-fire guns, thereby enormously increasing their efficiency. During the year twenty-five 6-inch, 30-caliber guns have been converted, making a total of eighty of this class which have been thus improved, while four 8-inch, 30-caliber guns which were removed from the "Chicago" to make way for a more modern type have been fitted with new and improved breech-mechanism. The time is approaching when the batteries of every ship in the navy will be of the rapid-fire type.

As was recently mentioned in these columns, the Bureau has been successful in securing satisfactory contracts for the armor required for the three battleships of the "Maine" class, the five battleships of the "Pennsylvania" and "Virginia" classes, the six armored cruisers of the "West Virginia" class and for the three protected cruisers of the "Milwaukee" class. It is highly gratifying to learn from the report before us that the ballistic qualities of the Krupp plates which have been made by the Carnegie and Bethlehem companies for Russia show that the armor makers of this country are capable of reaching the highest standard in the manufacture of face-hardened armor.

THE GREATEST IRON ORE MINE IN THE WORLD.

With a record to its credit of 1,000,000 tons of iron ore mined during the past twelve months, the Norrie mine on the Gogebic range may be considered the greatest iron ore producing mine in the world. This output represents about one-fifth of the annual ore supply of the Carnegie Steel Company, Limited.

The Norrie mine has been in operation during the past fifteen years. Several years ago the Oliver Mining Company, under which name the ore plants of the Carnegie interests are operated, obtained control of the Norrie mine, and since that time there have been wonderful improvements in the methods of mining and handling the ore and preparing it for lake shipment to the Carnegie docks at Conneaut. More than 3,000 tons

of ore are mined and shipped each working day of the year.

The railroads which carry the product to the docks have been brought to the very mouths of the mine. The "skip" cars which convey the ore from the mine dump their contents into immense ore pockets, which in turn empty into the railroad cars waiting beneath to receive their load. When there is an over-supply of ore, the surplus is dumped on the stock pile. Mining never ceases. The aspect of the Norrie mine is very different from that of the Menominee range, where great ore pits can be seen. The Norrie is a mine in the true sense of the word; for there is no open pit, no evidence of the ceaseless activity far beneath the surface.

The mine now known as the Norrie includes workings in which were four separate mines formerly known as North, East, and West Norrie and the Pabst. Two additional mines, the Vaughn and the Aurora, are also operated by the company under the name of Norrie, but their product forms a separate account. If the output were included with that of the Norrie, the sum total would be much in excess of 1,000,000 tons per year.

ANIMALS THAT BLOOM AND PLANTS THAT EAT MEAT.

BY CHARLES MINOR BLACKFORD, JR., M.D.

In general, animals move about to seek food, while plants are fixed to one spot and get their nourishment from the earth in which their roots are imbedded and the air that surrounds their leaves, but there are species in each "kingdom" that do not follow the rule. Botanists know of plants that have neither roots nor leaves, of others that have one but not the other, and of others still that are undoubtedly vegetable yet move about as freely as animals would do. On the other hand there are animals that never leave the spot on which they first took up their habitation, and that seem to trust to luck for food. The oyster and clam have thus lost the power of locomotion. There are many that have been separated from the plants only by the researches of recent years. Sponges, corals, sea anemones and the whole "sea cucumber" group were long believed to be vegetable, and many blue water sailors think so to this day. There are animals that seem to blossom as freely as do flowering plants.

The sea anemone is one of the commonest of these. It is found clinging to rocks in sheltered places along shore in practically every part of the world, for it is not confined to any special region. It grows only in comparatively shallow water, that is in depths of less than five hundred fathoms, although there is one species that lives in the open sea, but wherever found it is essentially the same in structure. It is a tough, leathery tube, spread out below into a "base" that fastens it to a rock or other foundation, and expanding above into the flower-like "disk" with the mouth in the center. All around the opening of the mouth are curling tentacles, not unlike the petals of a modern chrysanthemum. Some varieties are almost or entirely colorless, while in some others the tentacles are gorgeously tinted and rival the flowers of the field; but in all lurks death in a certain and horrible form. Watch some little creature touch the curving arms, and they will be seen to curl inward and wrap the intruder in their folds as they push it toward the mouth. The inner sides of the tentacles are covered by poison glands that sting the prey to insensibility or death and so stop the struggles that might prove disastrous to the anemone. When the mouth is reached, the captive is pushed into the hollow interior, and the anemone shuts up into a reddish brown ball until its meal is digested, when it spreads its fatal beauties for another victim.

Another great family of flowering animals is that including the "sea cucumbers." These animals have long, flattened bodies of a dark color that ranges from brown to reddish purple, and their most active movement is a slow creeping along the bottom. At one end is the mouth surrounded by the petal-like tentacles that push into it the mud and sand on which the organism lives. The mud of the bottom is filled with tiny beings that really furnish the food, but it appears to subsist on the inorganic mud itself. The most curious thing about the "cucumber" is that it takes lodgers in a way. It has a large cavity within its body that is filled with water, and into this cavity a little fish called the fierasfer works its way, and then lives within the helpless host. It is not a parasite, for it leaves its lodging to seek food, but it merely lodges in the holothurian for shelter, as the power of stinging that sea cucumbers possess to a high degree renders them fairly safe from molestation. The little lodgers do not seem to do any harm to their landlords except when several take quarters in the same one, and then they may inflict fatal damage by overcrowding.

The whole class of coral-forming animals resemble plants so closely as to deceive all but skilled observers. Few sights in nature are more beautiful than the "coral gardens" in the West Indies, where the gorgeously colored vegetation is almost entirely animal in character. The sea bottom near Nassau is formed of white coral sand and the débris of broken-down shells, and covering this is water of such transparency that the boat seems to float in air. A plate of glass is let into the floor of the boat, and the reflection of the sunlight from the white sand below illuminates the scene so that its smallest detail is visible. The sheet of glittering white sand is broken by dark masses of coral rock from which stream broad sheets of "fan coral" that naturalists call gorgonias, brilliant in vivid reds, yellows and purples. The darker masses of rock are spangled with anemones that equal the tints of a tropical forest, while the waving plumes of the sea feathers and the fantastic shapes of the glass sponges add the charm of variety of form. Clumps of bright-hued sea weeds that bear little resemblance to the dirty, faded green ones common on our coasts, are the only representatives of real vegetation that greet the eye. All the rest is animal, but the eye is deceived by a mimicry of plant life so perfect as to make the efforts of our human players crude indeed. The vivid stars of richest crimson that look like blooms on the branches of the coral are really the ends of boring annelids, worms that cut into the stony mass and ensconce themselves in the trunks of growing coral.

The birds and butterflies of the upper world are replaced by fishes of curious forms and flashing colors. The common names of these give even those who have never seen them an idea of their appearance, but their beauties can be appreciated only when in their native element and amid their normal surroundings. Angel fishes, parrot fishes, butterfly fishes, and shoals of smaller ones float through the water with easy grace, or dart into shelter with a quickness that would elude the eye but for the silvery gleam of their bodies as the sunlight is flashed back from the glittering scales. It is hard to believe that the fishes that seem to browse among the coral trees do not actually bite off the tips as sheep would nibble twigs, and even so close an observer as Darwin thought that they did so, but they are seeking the crustaceans that feed on the coral madrepores, or, perhaps, the madrepores themselves.

In the sheltered tropical waters grow anemones that are larger and more beautiful than those in our harsher climate. Some of them are two feet or more in diameter, and from this they range to tiny forms that can be found only after careful search, but from the largest to the smallest, they have a charm that lures many an unfortunate being to its doom.

Zoology has revealed no organism more at variance with the popular conception of animals than the "sea lilies" or crinoids, and when seen for the first time it is difficult to believe that they are not near relatives of the stately queen of flowers, but in all but form they are animals belonging to the same family as does the starfish. The crinoids grow in clusters like the beds of tiger lilies, and from the bed a jointed stalk rises sometimes to a height of several feet before the "lily" is reached. Surmounting this stem is a disk that bears the mouth, as in the case of the anemones, but the tentacles are much longer and rise around the margins of the disk in such a manner as to simulate a lily with marvelous perfection. Unlike most of the anemones, the crinoids live in deep water, and some of them have been dredged up from the depths in which it seems impossible for such tender and delicate things to exist. They were among the earliest types of animal life on earth, and their fossils are very common. They are in such preservation that they were called "stone lilies" before their true nature was understood, and their origin was much discussed before the living crinoids were discovered.

However anomalous the idea of flowering animals may appear, it is not more so than is that of plants that set traps and devour the prey taken by them. Flesh-eating plants seem to violate the rules of nature, yet the violation is apparent rather than real, for many plants absorb animal matter as part of their food. In general this is taken in only after decomposition has rendered the tissues soluble, but there are some bloodthirsty plants that kill and eat small animals as ruthlessly as do beasts of prey.

Among these the little sun-dew is most widely known, for its fame was spread over the world by the work of Darwin, who gave an elaborate description of it in his "Insectivorous Plants." The leaves of the sun-dew are studded with little projections on whose summits are drops of a clear, sticky liquid that glistens in the sun, as does dew, and from this the name is derived. The liquid attracts insects, either by its appearance or its odor; but when the unfortunate visitor seeks to sip the tempting draught, the leaf begins to coil inward and form a cup from which escape is impossible. The liquor runs down into the hollow and collects into a pool, in which the insect is drowned before being digested.

In the neighborhood of Wilmington there grows the "North Carolina Fly-Catcher," a plant that Linnæus called "the miracle of nature." This plant has leaves divided into two lobes that sit at a little less than a right angle to one another, and are fringed with tiny spikes. The upper side of each lobe is covered with minute glands that secrete a purple fluid, and also has a number of sensitive filaments arranged in a triangle. If an insect touch these filaments, the lobes shut up like the leaves of a book, the two parts turning on the midrib as a hinge, and the intruder is captured. If it be very small, it can escape through the spaces between the interlocking spikes, but otherwise the leaf forms itself into a temporary stomach in which digestion proceeds. The glands that were dry before, begin to secrete an acid liquid of a purple color, containing an enzyme like pepsin, in which the soft parts of the victim are disintegrated, and as this proceeds the pressure is increased until all of the digestible matter is absorbed, when the leaf gradually opens and the dry husk is extruded. The leaf will close on a bit of glass or stone as readily as on a fly, but the fraud is quickly discovered, and the indigestible matter rejected. The leaf is then ready to close again, even before it is fully opened, whereas when digesting food material it stays closed for several days, and is very sluggish in shutting again. The most vigorous leaves seem to be able to digest only two or three times in a lifetime, and the botanist Lindsay fed some specimens with such quantities of meat that they died from indigestion.

In Portugal there is a plant known as the Drosophyllum lusitanicum among botanists, that is so efficient as a fly catcher that the country people hang up branches of it for this purpose. It secretes a gummy, sticky fluid that entangles insects and kills them.

The common bladderwort is a foe to many small animals. It captures great numbers of water bugs, and has been known to catch and kill small fishes. From time to time the attention of fish culturists is called to this plant as a foe, but it is not regarded as a serious one.

THE IRON AND STEEL INSTITUTE AT PARIS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

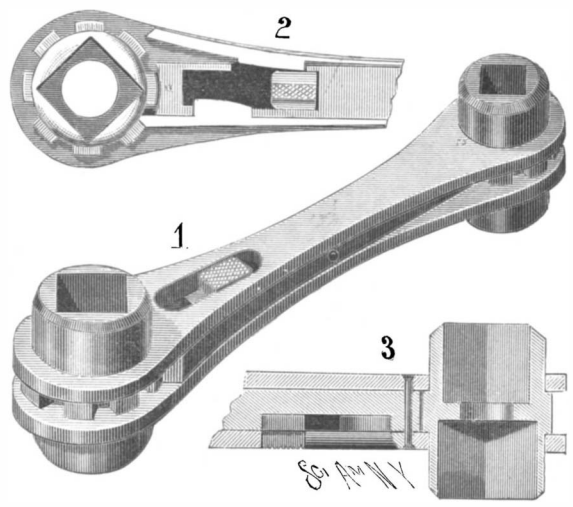
Among the most interesting of the papers read before the recent meeting of the Iron and Steel Institute at Paris, was that of Mr. Ernest Lange, of Manchester, relating to a new method of producing high temperatures and its application in practice. This method has been first practically applied by M. Goldschmidt, of Essen, and depends upon the reducing action of aluminium. This metal has a great chemical activity, and its affinity for oxygen gives it a considerable reducing power. Its heat of combustion has been determined by Mr. Thomsen, who finds that 393·6 calories are disengaged by the union of an atom of the metal with oxygen and water; as a result of the reaction, aluminium oxide, Al_2O_3, and water are formed. M. Goldschmidt, of Essen, was the first to apply the principle on a large scale in metallurgical work and overcome the difficulties met with by previous experimenters. He found that to cause the reaction it was not necessary to heat the whole mixture of the metallic oxide to be reduced and aluminium powder to its igniting temperature, but it sufficed to cause the ignition in a single point, and then the reaction soon spread throughout the whole mass. In this way exterior heating was dispensed with, and thus all danger of explosion was avoided.

In the method used by Goldschmidt, the crucible in which the action takes place remains at first cold at the exterior, and only becomes heated up by conduction, this being an excellent condition for resisting the very high temperature of the reacting mass in the interior. To start the action, one point is strongly heated by placing at the surface a cartridge containing a small quantity of a mixture easily inflammable and capable of giving a high temperature; the aluminium is used either in powder or in grains. The crucibles used should be such that their material does not enter into the reaction; for these, magnesia is preferable. The metals reduced from their oxides are obtained in a very pure state without alloy of aluminium, provided the reaction starts with a slight excess of the oxide; they are quite free from carbon, which is an important point. Under these conditions M. Goldschmidt has been able to produce 220 pounds of pure chromium in 25 minutes; he uses a special furnace in the form of a crucible; a small quantity of the mixture is poured in and ignited, and when the action is finished the process is repeated. The surface crust of corundum is remelted at each addition, while the metal unites at the bottom in a single mass; it is estimated that a temperature of 3,000° C. is reached in the interior of the crucible. Mr. Lange considers that this method is also of considerable value in rail-soldering and repairing of steel castings. In these cases the oxide best adapted is the red oxide of iron, Fe_2O_3, and it is mixed with aluminium powder, using the following reaction: $Fe_2O_3 + Al_2 = Al_2O_3 + Fe_2$. This mixture may be regulated according to the degree of heat it is desired to use. For relatively low temperatures pure aluminium is not required, or in other cases the oxide of iron may be mixed with magnesia or carbonate of lime. For soldering purposes alone, the reduced iron need not be absolutely pure, but this latter condition is necessary for the repairing of castings. As concerns the soldering process, this method offers great advantages in the construction of electric railways, where the continuity for the return current though the rails must be assured. It permits of operating on the spot, and avoids the use of rail-bonds, without requiring the transportation of a heavy outfit.

A NEW RATCHET-WRENCH.

Our illustrations picture a new ratchet-wrench invented by Joseph M. Nesley, of Grant, Mont. Fig. 1 is a perspective view, Fig. 2 a partial plan view, and Fig. 3 a partial longitudinal sectional elevation of the tool.

The wrench consists essentially of a lever-body to the top and bottom of which plates are riveted. The plates overhang the sides and ends of the wrench. The overhanging ends are perforated to receive a ratchet-wheel provided with two nut-receiving openings.



THE NESLEY RATCHET-WRENCH.

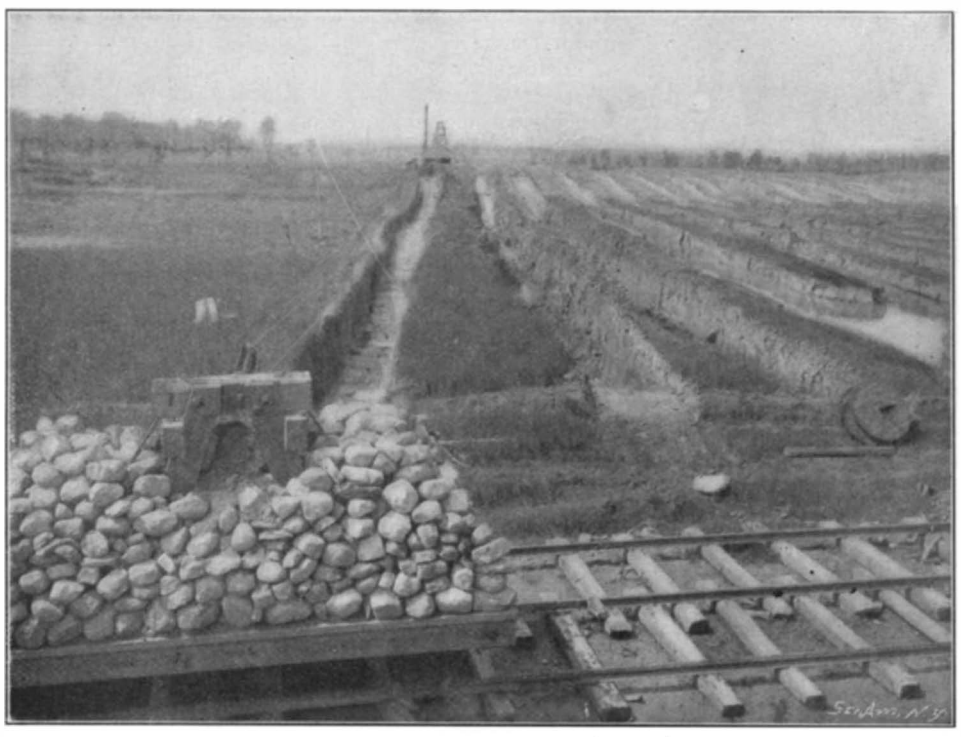
The teeth of each ratchet-wheel are adapted to be engaged by spring-pawls held between the overhanging side edges of the top and bottom plates previously referred to.

In order that the one or the other spring-pawl may be thrown into engagement with a ratchet-wheel, cams are formed near the ends of the spring-pawls. These cams lie, not directly opposite each other, but are located one somewhat in advance of the other, so that they may be alternately acted upon by blocks sliding in slots formed in the faces of the top and bottom plates. By moving the blocks back and forth, the spring-pawls are in turn thrown in and out of engagement with the ratchet-wheels. The tool can therefore be used as a right or left hand wrench without removal from a nut or bolt head. The construction of the wrench-body with a central lever-bar and top and bottom plates, which overhang to furnish a bearing for a socketed ratchet-wheel at each end, is cheap and compact.

POWER SCRAPERS ON THE ST. LAWRENCE POWER COMPANY'S CANAL.

Where the nature of the ground permitted it, extensive use was made, in the excavation of the St. Lawrence Power Company's canal, of the powerful steam-driven Vivian scraper. The character of the work done by these scrapers is very clearly shown in the accompanying illustration. The plant is composed of a tower and an anchor, which were placed on opposite sides of the canal. The anchor, which in the illustration is in the immediate foreground, carries a sheave, through which passes an endless cable. The tower carries the engine and boiler, and is placed far enough back from the cutting to allow of the formation of a spoil bank for the excavated material. Both the tower and the tail anchor are placed on trucks, which run upon parallel tracks on either side of the canal excavation, this arrangement being adapted to facilitate a change of position for the purpose of making a new cut. An endless cable is attached to the back of an unusually large scraper, which is 8 feet in length, 2 feet in depth, and has a cutting edge of 7 feet. Attached to the forward lower part of the scraper is a drag rope. The scraper is formed with a curved bottom to facilitate its tipping when it is full of material, and by keeping the cutting edge clear of the ground, to allow it to be easily dragged along the ground toward the spoil bank.

In operating this machine, the endless rope is wound in toward the tower, thus bringing the scraper to the commencement of the cut. The scraper is then raised to an angle of about 45°, and standing at this angle, and being pulled at the same time by the drag rope, it is forced into the ground and loads itself as it is drawn by the drag cable toward the tower. When it has been pulled onto the spoil bank, the drag rope is thrown out of gear and the endless rope is thrown in. This dumps the load. The endless rope is then reversed, and the scraper is drawn back to the anchorage for a fresh cut. The only labor required to operate one of these machines is that of an engineer, a fireman and two signal-men. The scraper has a capacity of from 3 to 4 cubic yards, and in favorable material it has made cuttings 26 feet in depth. The total yardage moved by this means at the canal in the year 1898 was 123,350 cubic yards, and in 1899 the total amount for the year rose to 207,500 yards. We are indebted for the illustration and particulars to Mr. John Bogart, the chief engineer of the company.



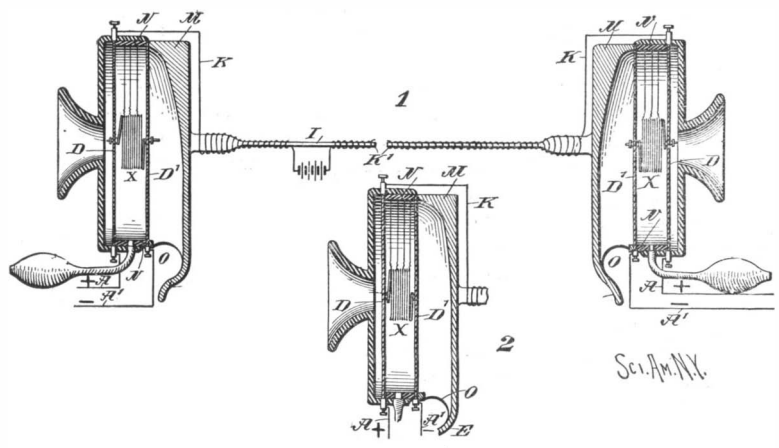
POWER SCRAPER AT WORK ON THE MESSINA CANAL.

THE PLECHER ELECTRO-PNEUMATIC TELEPHONE.

A new telephone transmitter and receiver has been devised by Mr. Andrew Plecher, of Stanford University, Cal., the peculiar construction of which is shown in the accompanying diagrams. Of these diagrams, Fig. 1 is a view of two combined transmitters and receivers; Fig. 2 is a slightly modified form.

The transmitter and receiver consists of an iron box, *M*, connected by a heavy iron wire, *I*, with a similar iron box, *M*. In each iron box are two thin diaphragms, *D* and *D'*, insulated from each other by a non-conducting marginal ring, *N*, forming an air-tight joint with the diaphragms. Behind the diaphragms in the box, *M*, is a chamber having an opening, *O*, for the admission and discharge of sound waves. In the hermetically-sealed chamber thus constituted a coil, *X*, of fine iron wire is suspended, so wound that the individual turns nearly touch one another. One end of the coil is connected with one diaphragm, *D*, and the other end with the second diaphragm, *D'*. When an electric current passes through the coil, the turns will touch, since the coil becomes magnetic. The vibrations of the diaphragms will separate or bring into contact the turns of the coil, whereby resistance is thrown into or out of the circuit, thereby causing a corresponding fluctuation of the current. For the magnetic action of the current causes the turns of the coils to be attracted. Then when the vibrating diaphragms move outwardly this lateral contact is broken, and the resistance of the whole coil will be thrown in by compelling the current to traverse the coil lengthwise instead of leaping from turn to turn. The air-vibrations propagated by the voice act on the front face of the diaphragm, *D*, through the mouthpiece and on the rear face of the diaphragm, *D'*, through the opening, *O*, whereby the two diaphragms are caused to vibrate in opposite directions. The effect on the resistance varying coil, *X*, is therefore augmented. The fluctuations are transmitted through a circuit composed of a fine wire, *K*, connected with the diaphragm, *D*, and wound around the central stem of the box and the heavy wire, *I*, thereby converting the box and the wire, *I*, into a magnet. The wire, *K*, is connected with one pole of a battery. From the other pole of the battery a similar wire, *K'*, passes around the wire, *I*, and is connected as shown with the diaphragm, *D*. In order to cause the hermetically sealed chamber between the diaphragms to be expanded or collapsed, to regulate at will the amplitude of movements of the turns of the coil, *X*, a bulb is employed to place the air under regulable tension.

In Fig. 2 the ends of the coil have carbon buttons mounted on metal disks. The coil is sustained only by threads. The carbon buttons are arranged to bear with an elastic pressure against the diaphragm-plates, *D D'*.



AN IMPROVED TELEPHONE.

London's New Electric Railway.

The Baker Street and Waterloo Railway, the third electric railroad in London to be propelled by electric traction, is rapidly approaching completion, and one section will shortly be opened to the public. The total length of the line is a little over five miles, and extends from the Elephant and Castle Circus on the south side of the river to Paddington Station, the terminus of the Great Western Railway, in the west end of the metropolis. The route passes under the busy thoroughfares of Northumberland Avenue, Charing Cross, Regent Street, and Edgware Road, and is a connecting link between four of the great trunk railroads of the country, and also the new Central Electric Railway of London and the underground District Railway.

The system of construction is similar to that adopted in the Central London Railway, consisting of two parallel tunnels, throughout its entire length, bored upon the Greathead system. The engineers are Sir Benjamin Baker, K.C.B., Mr. W. R. Galbraith, C.E., and Mr. R. F. Church, C.E. As the railroad passes under the River Thames, advantage was taken of the opportunity of sinking two temporary shafts from a timber staging in the river, since by this means it has been possible to extend the work of boring simultaneously north and south, and to convey the ballast excavated to the top of the shaft and to discharge it direct into the barges, without necessitating any intermediate cartage. Work was also able to be continued incessantly without inconveniencing the traffic in any way, since the shafts have been sunk on one side of the river, so as not to obstruct the river channel in any way. The engineers have successfully driven the tunnel throughout the water-bearing gravel of the bed of the Thames, without the slightest hitch.

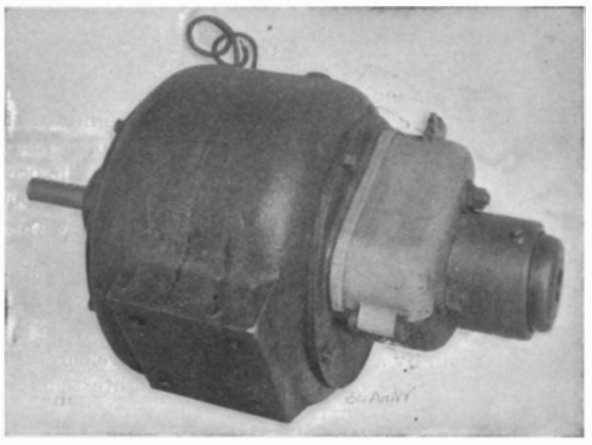
The electrical generating station, and depot for the accommodation of the rolling stock, etc., is located about a quarter of a mile distant from Waterloo Station on the southern side of the river. It is anticipated that the trains will complete the whole journey from the Elephant and Castle Station to Baker Street in twenty-five minutes, the speed of the trains being about 13 miles an hour. A three minutes service will be inaugurated, so that rapid transit may be assured. The railway will be exempt from competition, since at the present time the only means of traveling across Central London in this direction is by omnibus, the journey by which occupies about one hour and a quarter. Then, again, the railroad will serve four of the busiest traffic centers of the metropolis. According to the statistics published by the London County Council, the Elephant and Castle is the second largest point of concentration of passenger traffic in London, followed respectively by Charing Cross, Piccadilly Circus, and Oxford Circus. It also taps one of the most thickly populated artisan districts in London, so that the revenue derived from this source alone will be considerable.

The total cost of the scheme will be about $15,480,000. It is estimated that the total gross receipts will amount to $1,350,000 per annum, and that the yearly working expenses, allowing the running of 300 trains daily for six days in the week, and 150 trains on Sundays, will aggregate $500,000. In view, however, of the rapidly increasing suburban traffic of London, and the marvelous extension of the metropolis, there seems every probability, as in the case of the Central London railroad, that the service will be inadequate. In this event the service will be rendered quicker, and longer trains will be run, since the station platforms are of sufficient dimensions to accommodate trains of nine carriages.

A RECHARGING MOTOR FOR ELECTRIC VEHICLES.

The one great drawback to the present electric motor carriages is their inability to cover more than twenty-five or thirty miles on a single charge, under the most favorable conditions. When a hilly road is encountered, the capacity of the battery is considerably reduced, owing to the heavy discharges it is called upon to make in driving the carriage up hill, and there is a consequent reduction in mileage of from one-third to one-half. Of course, in descending the hills, the vehicle runs by gravity, and no current is taken from the battery. The weight of the vehicle is such, however, that even at comparatively slow speeds the momentum is great enough to generate considerable current if the motor is used as a dynamo. The makers of the Waverley vehicles were, we believe, the first in this country to make use of this principle on their carriages for braking purposes. Their machines are equipped with a set of resistance coils, through which the current generated by the motor may be made to pass, the braking effect becoming greater as more current is allowed to pass. This forms a very simple, easily controlled and powerful brake, with no wearing parts and nothing whatever to get out of order. It will work on the steepest hills as well as on the level, and will retard the motion of the carriage to any speed desired.

It is apparent that in such a system of electric braking, the current generated is wasted and its energy dissipated in the form of heat when it passes through the resistance coils. To conserve this electrical energy by utilizing it in charging the storage batteries, is one of the features of the improvements herewith illustrated, which have the merit of maintaining or equalizing in some degree the otherwise reduced mileage of the vehicle. The chief difficulty to be overcome lies in the double direction of the current. In order to recharge the batteries, the current must pass through the circuit in the opposite direction to what it does when the battery is discharging and operating the motor, while when simply a resistance coil is employed, the direction of the current does not matter.



THE CHARGING MOTOR.

The motor which we illustrate is the invention of Mr. J. C. Lincoln, of Cleveland, Ohio, and is manufactured by the Lincoln Electric Company of that place. It is a four-pole compound wound machine of substantial construction. The four shunt coils are connected respectively to the four crates of the battery, numbered 1, 2, 3, 4 in the diagram, and are in circuit when the controller is on any of the six positions or notches—four forward and two backward. This connection is made at the controller by four disks against which press spring conductors, and which will be noted at the right-hand end of the controller in the illustration. The coils take but a small amount of current, about three-fourths of an ampere. They are designated by the small figures 1, 2, 3, 4 on the motor in the diagram, while the series coils are marked *S*. The letter *A* on the motor refers to the armature. *V* refers to the voltmeter.

The three speeds are obtained by coupling the four crates of battery cells (ten in each crate), first in parallel, then two in parallel and two in series, and finally all four in series. Starting from the extreme left-hand terminal, marked *A* in the diagram, which is connected by the controller with the B_1+ terminal of the battery, the current passes first through the ammeter, then through the plug switch, thence through the motor armature to its right-hand *A* terminal. As this is connected by the controller with the terminal, *S*, the current continues through the series coil and returns to the B_4- terminal of the battery.

When the carriage descends a grade, if the current is kept on, the speed continues to increase until the counter electromotive force of the armature equals that of the battery, which would be 80 volts with the controller on the third position or notch. At this point the motor will take no current and the ammeter pointer will stand at 0. If the speed increases still further, the counter electromotive force of the motor will exceed that of the battery, and the armature will generate a current in the opposite direction. The motor will do this because the shunt coils of the electromagnet maintain their polarity the same, notwithstanding the fact that the series coils are now working against them.

The field magnets are somewhat weaker in this case, since their magnetism is now the difference of that produced by the shunt and series coils, whereas before it was the sum. By this arrangement, since the field magnetism is weaker, the amount of current generated is less than would be produced if the field coils operated in unison, and the charging proceeds for a longer period with a lighter current, while the speed of the vehicle gradually decreases.

Moving the controller to the second and first positions reduces the voltage of the battery 40 and 20 volts respectively, causing a heavier current to be generated by the armature, which will thus produce a much stronger braking effect, and the vehicle will stop quickly.

It will be readily seen that this motor is of great value in a hilly region, especially as a considerable percentage of the additional current consumed in ascending a hill can be recuperated in descending it. The motor is also said to be considerably more efficient than a series one when running under light loads on the level. Slowing down and stopping can be accomplished without using an extra brake lever, and the batteries each time receive a brief recharging, which, although not amounting to very much, perhaps, certainly has a tonic effect; for it seems to be the general experience that freshly charged batteries will yield considerably more current than when they have been standing some hours. The inventor claims that with this motor a carriage will run from twenty to forty per cent farther than with the usual series wound motor.

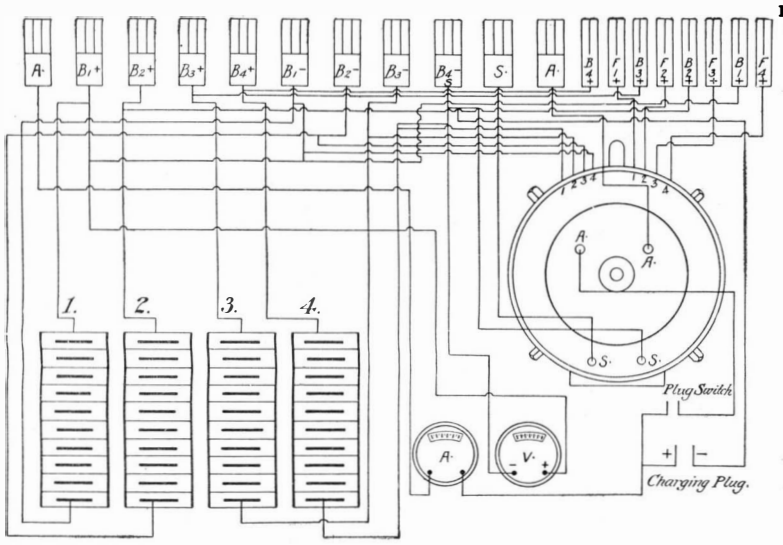
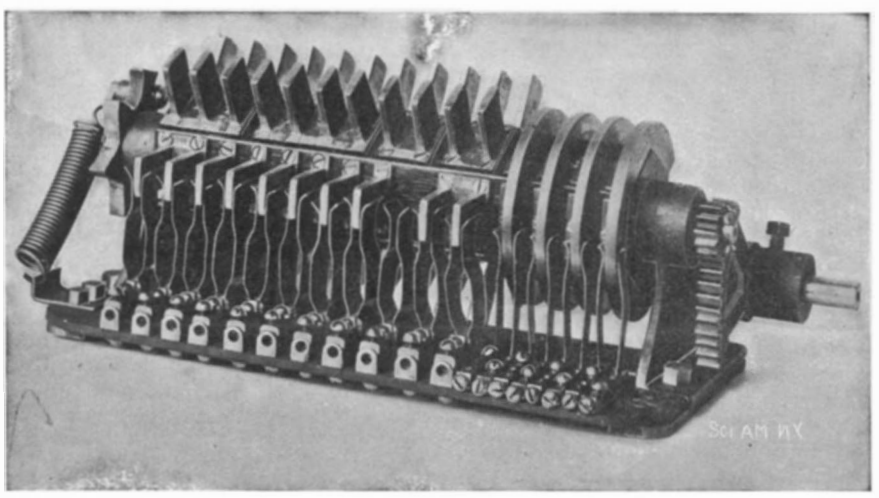


DIAGRAM OF CONTROLLER CIRCUITS OF RECHARGING MOTOR.



CONTROLLER FOR A RECHARGING MOTOR.

AUTOMATIC RECHARGING ELECTRIC VEHICLE.

Carloads of Molten Iron.

The construction of a new bridge across the Monongahela, to be opened for service within the next few days, directs attention afresh to a striking feature of modern metallurgy. The usual way to make steel is to melt up cold pig iron, to which other materials are added, and then purify the mixture by burning out certain undesirable elements. Pig iron, however, is itself the product of a previous heating process, in which the ore is melted with carbonate of lime to remove the oxygen. It occurred to some ingenious Yankee a few years ago that if the product of the blast furnace could be converted into steel before it had cooled sensibly, a great economy in fuel would be secured.

The new bridge just mentioned has been built for the Carnegie Company, and will be used to convey molten iron from the Carrie furnaces to the Homestead Steel Works, nearly a mile off. At the present time Homestead obtains molten metal from Duquesne, about four and one-half miles away! The new route has been laid out so as to save time and distance, and, possibly, caloric, too. There has been for some time one "hot metal" bridge across the Monongahela, controlled by the Carnegie Company, and, besides the new one about to be opened, a third is in process of erection for the Jones & McLaughlin interest. It will thus be perceived that the practice has proved so successful that it is being rapidly extended.

One gets a vivid idea of this remarkable procedure when he reads about the precautions taken in the construction of the new bridge to prevent harm in case any of the melted metal leaks or slops over while in transit from the iron furnace to the steel works. The spaces between the ties are to be filled with sand, so that no iron may fall to the decks of passing steamers. The ties will be of wood, but are to be protected by a covering of sand. On either side of the track there will be raised a screen of heavy metal plates, faced with firebrick and reaching to a height of four feet. An extension of thinner plates will bring the screen up six feet farther. The cars are ladle-shaped, and the molten metal runs directly into them when the furnaces are tapped. A locomotive then draws the train to the steel works at a moderate pace. The glowing freight, says The New York Tribune, is still in a fluid condition when it reaches the mixers there. If it were not, the cars would be ruined.

Substitute for Gutta-percha Bottles.

For the preserving of hydrofluoric acid, which is frequently used for cleaning heliotype plates, in the manufacture of dry plates and for etching on glass, only the expensive gutta-percha bottles have been used heretofore, which, however, become brittle and hard in time, and therefore constitute danger. A very convenient substitute is obtained, according to the Deutsche Photographen Zeitung, by pouring hot wax into a glass bottle with suitable spout, and coating the inside with it, by allowing the wax to harden with constant turning. The neck, as well as the spout, is also coated with wax. Instead of cork or glass make a stopper of glazier's putty. The wax coating at the spout prevents drops from running down to the outside wall.

THE electric tramways of Berlin are to undergo extensive development and extension. Intercommunication with the heart of the city and the remotest suburbs is to be established, and a general two cent fare will be charged throughout the whole system. Unfortunately, however, the number of accidents is increasing proportionately with the extension of the system. During twelve weeks over sixty tramway accidents occurred, nearly thirty of which terminated fatally.

THE MANUFACTURE OF EDISON PHONOGRAPH RECORDS.

The Edison phonograph has become such a familiar object in our modern home life, and its mechanism, in spite of its marvelous ingenuity, is so straightforward and easily understood, that it is difficult, in giving a description of this prince of toys, to tell the multitudinous possessors of them anything that they did not know before. If one were asked to name the particular part of the phonograph which possesses the greatest interest and which is the most essential to its success, he would have to mention the cylinder of wax upon which the waves of sound are cut by the dainty little sapphire turning-tool known as the stylus.

The great growth in popularity of the phonograph, and the necessity for keeping the owners supplied with fresh "literature," has caused the mere work of manufacturing the records to assume truly enormous proportions. Evidence of this is shown in the storage room of the Edison Phonograph Works, in which are to be found tier upon tier of storage "bins," whose contents represent records of 3,000 distinct subjects, or nearly half a million wax cylinders in all.

The first process in the manufacture of records takes place in the melting room, where the proper constituents to form the special grade of wax employed in making the records are brought together and melted in several large vats, each of which contains about 1,000 pounds. There are three meltings in all, and between each the fluid is carefully strained to remove any hard or gritty impurities which it might contain; for it is evident that the presence of foreign substances, even a few particles of fine dust, might easily produce fatal irregularities in the grooves of the record. The first two meltings take place in the melting room, and the third in the moulding and shaping room, of which we present an illustration. On entering this room, the most conspicuous feature is several large, circular, rotating tables, set around the periphery of which is a number of round, iron pins which form the core of the mould. Concentrically around each of these pins is placed a brass sleeve. The wax is taken from the melting vats in a can and poured into the moulds in the manner shown in our illustration. The tables are constantly rotated, thus bringing the moulds, which cool very rapidly, round to the workers on the opposite side of the table, where the wax cylinders are removed. The moving table brings the empty moulds back to the starting point, where they are again filled from the pouring can. The cylinders are cast with an interior spiral thread, which adds somewhat to the strength of the cylinder, and forms the bearing surface when the wax cylinder is placed on the mandrel of the phonograph. After they have cooled, the cylinders are first reamed out to gage, then edged and rough-turned, and finally given a finishing cut, the finish turning being done with a fine sapphire knife. The records are then given a final inspection, in which those that show the least sign of imperfection, such as a hair crack, or a failure to meet the gage test, are rejected. The cylinders are now ready for the important work of making the records.

It should be mentioned just here that in addition to the standard size of records, measuring about 2¼ by 4 inches, with which the public is more familiar, the Edison Company manufacture a larger size, known as the concert record, which is about 5 inches in diameter. The advantage of the larger size is that the grooves are longer and the curves of the depressions are of longer radius, with the result that the ball-point of the reproducer is able to follow the grooves more closely and give a more perfect reproduction of the sound waves.

One of the upper floors of a large building in the record department is divided into a number of rooms, in which the specialists who are employed by the Edison Phonograph Works are kept steadily at work speaking, playing or singing into the recording machines. One of our illustrations shows the methods adopted in producing solo records, whether instrumental or vocal. In this case the violinist stands with his instrument immediately and closely in front of three converging horns, each of which connects with a recording phonograph. The only difference between a recording and a reproducing phonograph is in the nature of the little sapphire tool by which the diaphragm rests upon the wax record. In making the record, the "recording stylus" is used, and in reproducing the record, the "reproducing ball" is substituted. The difference between the stylus and the ball is that the point of the stylus is cup-shaped and ground to a fine cutting edge, which, as it travels over the surface of the wax cylinder, is driven more or less deeply into the material, and turns off a shaving which varies in thickness, according to the quality of the sound waves which fall upon the diaphragm. It is extremely interesting to watch the endless stream of fine hair-like turnings which falls from the little tool while the record is being made. One of the first things that strikes a visitor to the record room is the rapidity with which the artists sing, the speed being much greater than that to which one is accustomed in a music hall or opera house. Moreover, the songs are sung with the full power which would be used before a public audience. As soon as the record is made, it is taken off the mandrel and placed in a phonograph and reproduced to test its quality. If there is the slightest defect, it is, of course, rejected.

Among the most popular records are those of band music, and for making these the company maintains a full instrumental band, which is occupied steadily, under the baton of a conductor, in playing popular airs, marches, waltzes, etc. The musicians are so grouped around the phonographs that the volume of sound from each instrument strikes full upon the horns, the front row of the performers being seated on ordinary chairs and those behind on raised seats. On the occasion of our visit there were no less than sixteen phonographs on the racks in front of the band, each with its horn pointing toward the musicians. In this case, as in the case of solos, the music is performed at full power.

The testing of the phonograph records is done in a separate room by a corps of experts, who are careful to throw out every record that gives the slightest suggestion of a defect. Long training in this work has made them sensitive to irregularities in tone and quality which would scarcely be noticed by the average listener. It is to this searching examination that the uniformly high quality of the Edison records is largely to be attributed.

Our last illustration shows the phonograph testing room. This test is just as important as, and perhaps more so than, the testing of the wax records themselves. The work done in this department is really a matter of testing the testers, for during the construction of the machines every part of the phonograph, as it is completed, is subjected to close inspection. It may happen, however, that in the assembling, or in the frequent handling, a trifling injury may have resulted to some part; there may be a slight lack of adjustment, or the bearings may be clogged with oil, and it is the part of the final inspector to detect such faults and see that the machine works with the absolute smoothness necessary to good phonographic results.

The phonographs themselves, after passing this test, are put in cabinets and sent to the shipping department; the phonograph records, after the final inspection, are each carefully wrapped in cotton, then in paraffine paper, and finally placed in cardboard boxes on which are printed the catalogue numbers of the records. The boxed records are then stored in numbered bins, and on the receipt of an order, it is a simple matter to select the records, pack them in cases or barrels and wheel them to the cars, which are brought by a switch to the doors of the shipping department.

In closing we would make mention of the really admirable system of shop management which is displayed throughout the whole of the works—a system which displays very markedly that characteristically American arrangement of the shops themselves, and of the machines with which they are crowded, which aims at minimizing the amount of handling and transportation to which each individual piece is subjected in its transformation from the crude material to the finished article. There are, as this journal has often pointed out, several elements which conduce to the commercial supremacy of the country; and to nothing is the cheapness of our products more directly traceable than to that carefully-thought-out distribution of the work and orderly and consecutive arrangement of the machines, of which these works are a striking example.

Automobile News.

A prominent firm of cycle manufacturers in Coventry (England) have devised a lady's motor bicycle. The machine is of the conventional design, with the open frame, and the motor, which is a two horse power oil engine, is compactly attached to the rear wheel. The cycle is started in the usual manner by pedaling, and the speed of the motor is controlled by a small lever fixed to the handle-bar.

Next year the Automobile Club of England proposes a more exacting motor car test than the 1,000-mile trial of 1900. The experiment will continue over a period of three weeks, commencing, as at present arranged, on August 12, 1901. The cars will leave London en route for Shaftesbury and Plymouth, to cover which distance will occupy two days. From Plymouth they will proceed to the North of England through the western counties to Carlisle. This journey will include a series of hill-climbing competitions on the two steep sharp gradients Dunmail Raise and Shap Fell. Glasgow will be the next destination, where the cars will be placed on show in the Manufacturers' section of the Exhibition. A short independent tour for five days is then projected through the Highlands, the cars reassembling at Glasgow on August 26. The return to London will be made via York, Lincoln, Norfolk and Welbeck Park, at which latter place the speed trials will be made, as on the last occasion. It is contemplated that the cars will travel 100 miles per day, with an aggregate distance for the tour of 1300 miles, independent of the five days traveling in the Highlands.

Science Notes.

Mr. Marshall H. Saville, of the American Museum of Natural History, has started for his winter work in southern Mexico, where he will continue his excavations in the territory formerly occupied by the Zapotecans.

An institution was opened in Belgium for the alleged cure of tuberculosis by the exclusive raw meat diet. After a trial of a few months, the experiment was abandoned, as it was found that there was no efficacy in the Richet cure.

The various scientific departments in England recently held a conference in which they sought to obtain government powers for protecting the delicate instruments in the Kew and Greenwich observatories from any magnetic disturbances that arise from the working of electric tramways and railways in their vicinity.

The Duke of Abruzzi on his recent Arctic expedition carried with him a small balloon, similar in construction to those employed in the Italian army, for the purpose of pushing farther north when the vessel became blocked by the ice. It, however, proved useless. The duke is now busily engaged upon the design of a new balloon, specially adapted for such an object, which he will take with him upon his next expedition.

There is to be a ceramic exhibition in St. Petersburg in December. Its aim is to show the public the progress made by Russia and other countries in artistic and industrial ceramics. Only works of artistic excellence will be admitted to the exposition, but also those which, lacking the preceding condition, are yet distinguished by the originality of their design, form or mode of manufacture.

The city budget of New York city for 1901 calls for the expenditure of $98,100,413 43, an increase of $8,321,440.95 over the budget for 1900. The largest sums are for education, $18,512,817.69; interest on city debt, $12,100,206.05; police, $11,983,343.42; the redemption of the city debt, $10,332,173.18. It is curious to note that The City Record, in which various advertisements relating to the city are printed, has $563,200 appropriated for it, an enormous sum, exceeding that appropriated for buildings.

Sir George Newnes, who financed Mr. Borchgrevink's recent expedition to the Antarctic zone, has placed the whole of the scientific spoils collected by the late Nikolai Hansen, the scientist to the expedition, at the disposal of the Natural History Museum at South Kensington. The collection comprises birds, beasts, fishes, and an assortment of other innumerable curiosities. The authorities at the museum will select all that they require, and transfer them to the experts in the respective departments, to be duly examined and annotated.

At a recent congress of German anthropologists, which was held at Halle, Professor Dr. Klaatsch, of Heidelberg, read a paper in which he contended that the hypothesis of the direct descent of man from apes was no longer tenable. His conclusions were based upon the biceps muscle of the thigh. He stated that it was a mistake to regard man as the most perfectly developed mammal in all respects. His limbs and teeth do not show any high degree of development, and he is superior to other animals only in his brain development.

The Rev. J. M. Bacon, F.R.S., proposes to make a balloon ascent during one of the thick, impenetrable fogs which visit London during the winter months. He proposes to ascend to the higher limits of the fog and to explore scientifically its constitution. He also proposes to discharge small cartridges of guncotton at great heights, in order to ascertain whether the concussion will dislodge or disperse the fog in any way. He has already carried out several experiments with similar cartridges for acoustical purposes, at varying altitudes.

Arrangements are being made among the various scientific and mechanical institutions in London to hold an engineering congress at the Glasgow Exhibition next summer. The congress will consist of nine sections, with Lord Kelvin as Honorary President. The President of the Institution of Civil Engineers will preside over the first section, while other sections will be presided over by Sir Benjamin Baker, F.R.S., and Sir John Wolfe-Barry, F.R.S. Already a sum of over $16,000 has been collected as a guarantee fund for defraying the expenses of the scheme.

The latest development of the automatic machine is an apparatus in which letters and telegrams may be placed to await the call of the addressee. The communications are inserted in the machine in such a manner that the name and address is plainly visible through a small window. To obtain possession of a missive, one places a penny in the slot. Should a reply be necessary, the insertion of another penny into the instrument will insure the delivery of an envelope and sheet of note paper, and the reply may be written upon a small desk attached to the machine. It is stated that the English postal authorities have consented to place letters and telegrams in these automatic "postes restantes" if the address of the particular machine is supplied.

Engineering Notes.

A subway scheme is proposed for Chicago, every other street in the business section being involved in the project.

It is said that the Krupps are negotiating with Spanish capitalists for the organization of a company in Spain to build ironclads and manufacture ordnance.

The increasing importation of American steel into Great Britain is interfering with the trade of Swansea, as the revenue obtained from the importation of raw material used in making bars, and the industry itself, was threatened with extinction.

The à la carte system of dining cars of the Pennsylvania Line west of Pittsburg has been abandoned in favor of the table d'hote plan, ballots having been given to passengers for several months in order that they might vote as to their preference.

The Lake Shore and Michigan Southern Railway has instituted a house to house canvass in Chicago with a view to causing the people to test the facilities of their suburban service, and free tickets are left at the houses which entitle the holder to one free ride in either direction.

Probably the most valuable stock in the world is that of the London New River Company, of London. There are only 72 original shares, of which 36 are "adventurers' shares" and 36 "king's shares," the former commanding higher prices than the latter. A share sold recently for $625,000.

Preparations are being made to move the Columbus monument at the circle at Fifty-ninth Street and Eighth Avenue, New York, on account of the underground railroad. The foundations were so deep that it was considered cheaper and safer to move it temporarily, and then return it to its present location.

Experiments are being carried out in Germany as to the perforating capacity of the latest Mauser model, and the latest field guns, and as targets several hundreds of pauper corpses are being used. The bullets, when fired at a comparatively short distance, tear asunder the soft inner organs and finally mangle the bodies.

A new light system has been introduced into the village of Sinnozheim in Würtemberg. From a large central petroleum reservoir, the oil from which the light is produced is distributed to the different lamps through copper tubes; the petroleum is then vaporized by special apparatus and burner. A large lighting plant of this system is to be put in the railroad shops at Stuttgart.

The American red gum wood is now being largely employed in London for street paving purposes. Regent Street, Piccadilly, and the Haymarket have recently been paved with this wood, and it is to be employed extensively in other parts of the metropolis. Although the wood is not so hard as the red woods of Australia, it is more durable than deal or any other timber, while it affords the best foothold for horses. A prominent feature of the wood is that it neither shrinks nor expands under the influence of dry or wet weather, which are great recommendations for its utilization for paving purposes.

An American hydraulic engineer, Linden W. Bates, has been asked to undertake the widening of the Suez Canal. The corporation is desirous of rendering the canal available for the passage of ships of greater draught than can now be accommodated. It is to be carried on by a colossal dredging process. Mr. Bates has just completed three very large dredging ships for the Queensland government. The largest of them is about to leave the Armstrong-Whitworth yards at Newcastle-on-Tyne, and the Australian colony has consented to have the machinery stopped en route and test its efficacy for the purpose. Mr. Bates has had great experience in matters of this kind, as he helped to lay out the Chicago Drainage Canal and designed the big Mississippi works at Memphis for the War Department.

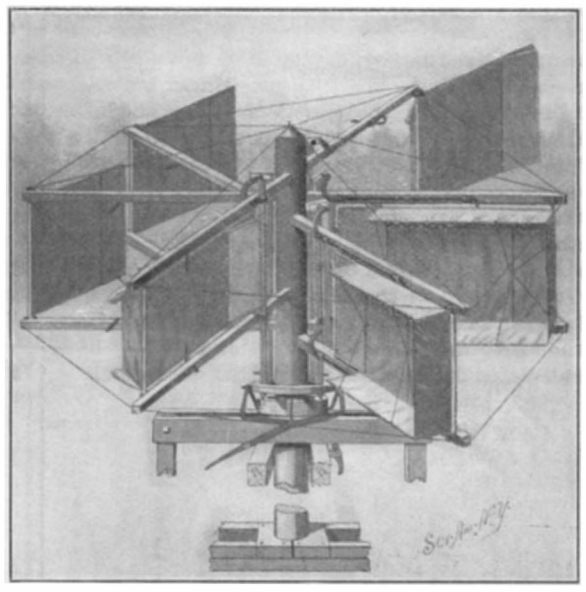
The Midland Railway Company, of England, have recently purchased four Pullman sleeping cars for use on their system. Each car measures 59 feet 10¾ inches over the buffer beams, and 13 feet 1 inch in height from the rail level to the top of the roof. The bogies upon which the car is built were constructed by the Midland Railway Company at their own shops, so that they differ somewhat from the prevalent American pattern. The fittings for the vacuum brake were also supplied by the railway company. The car was dispatched to England in sections, and the parts reassembled at the railway works. The car is divided, one portion of it being provided with five staterooms, each of which is supplied with bed, folding washstand and usual appurtenances. The remaining portion of the car is a general saloon, and is only converted into a sleeping apartment at night by making up the berth between the two seats. All the berths are on the same level, the company having abandoned the idea of placing one berth over the other. A smoking saloon and buffet are attached A charge of $1.25 is made for the use of this saloon in addition to the railway saloon.

A NOVEL WIND OR WATER MOTOR.

We present herewith an illustration of a novel motor, patented by Marcin Puszkar, 18 Greenwich Street, New York city.

From a central driving shaft, a number of arms radiate, which serve to carry vanes. Of these vanes, each has one end pivotally attached to the outer end of one of the arms, so that it can swing freely. Stops are movably secured to the arms and arranged to project into the path of the vanes to bring them into driving connection with the arms. Bars are slidable transversely on the arms and are operatively connected with the stops. A collar or ring normally engages the ends of the bars, the ring being provided with alternating elevations and depressions. The collar is locked by means of a lever. A stop-lever is arranged to engage the projecting portion of the lock-lever to unlock the collar whenever desired. By means of this lever mechanism, the collar can be made to rotate with the arms, or it can be thrown out of gear, so that the bars will sink into the depressions, thereby stopping the motor.

The vanes, as our illustration shows, are of peculiar construction. Each vane consists of a rectangular frame to which a cover is secured. To this rectangular frame canvas-covered side frames are pivoted so that they can fold inwardly. At the pivotal or outer end of the vanes a folding canvas-covered end frame is attached, and is opposed by a balancing-frame likewise covered with canvas. The vanes are pressed by the current against the stops. When the vanes approach a position directly in line with the wind, they are swung around on their pivots, partially by the action of the wind on the end frames. This action is counterbalanced by the balancing frame, thereby preventing the vanes from swinging around too soon. The vanes range in the direction of the wind, the several frames folding against the main frame. Against the current



THE PUSZKAR CURRENT MOTOR.

the vanes present a narrow edge, and therefore offer little resistance, automatically preserving a direction parallel with the current until they strike the stops again.

Strike Insurance in Austria.

A number of Austrian manufacturers have recently formed an association for insurance against strikes, says a United States consul. It is the object of the association to indemnify its several members for all losses sustained by them from unjust strikes which may break out in their respective establishments, whether voluntary, sympathetic, or forced. Each member is to pay a weekly premium equal to from 3 to 4 per cent of the amount of his pay-roll. The indemnity to be paid to him in case of a strike is to be, tentatively, 50 per cent of the wages paid to his employes for the week next preceding the suspension of work. It is provided, however, that no indemnity shall be paid if a committee of confidential agents appointed by the association shall, after a full investigation of all the circumstances, find the strike a justifiable one.

It is worthy of note that a report upon and discussion of the subject "Insurance against strikes" formed a prominent feature of the programme of the national convention of Austrian manufacturers.

It appears that this movement of industrial employers is not confined to Austria. It is reported that a similar insurance association, though on a smaller scale, has been organized in Leipzig. Both the Austrian and German associations, it appears, recognize in principle the justness of strikes; which is, at least in this country, an important concession to labor. Whether this recognition will have any practical result, remains for the present a matter of conjecture.

THE French roller boat built by M. Bazin has been broken up at Preston, England, after being exhibited for some time as a curiosity. Her construction was most intricate, and the amount of metal used enormous.

Electrical Notes.

Telephonic communication has been established between St. Michael and Nome by means of a temporary submarine cable. The toll is $2 for ten words.

A Russian medical man has decided that the electric light is least injurious to the eyes. He says that the oftener the lids are closed the greater the fatigue, and consequent injury. By experiments he finds that the lids would close with different illuminations per minute: Candle light, 6·8; gas, 2·8; sun, 2·2; electric light, 1·8.

The single-phase system is rapidly being supplanted in England. The Sheffeld corporation have arranged with the Electrical Construction Company, Limited, of Wolverhampton, for the conversion of their existing plant into the two-phase system. They have also ordered two new two-phase alternators and engines to work in connection with the same at a cost of $69,200.

The new electric railway at Paris has proved a great success, despite the mishaps that have occurred thereon from time to time. From the date of its opening on July 19 until October 31, 13,000,000, passengers were carried. Occasionally the daily number of passengers carried amounted to 170,000. It was originally intended to run only 270 trains per day, but this number has been considerably increased, and further trains are to be added.

An accident occurred on October 19, on the Paris Underground Railway, in which twenty-nine persons were injured, and two were fatally hurt. The accident occurred near the Exposition grounds. A train entered the station at the Place de la Concorde, and then backed out again. The train which followed it misunderstood its signal, and the result was a collision. As both trains were moving slowly, the damage to the train was not very great. Traffic, however, was delayed for several hours.

The French government have decided to establish their own service of submarine cable communications. This decision has been arrived at as a result of the Transvaal and Chinese campaigns, when the majority of the messages from France had to be dispatched over lines under British control. Even the communications that pass between the home government and the various ministers abroad have to pass through English hands. It is proposed to establish four cable lines interconnecting the colonies and the home country.

In the fire which destroyed the telegraph department of the Manchester post office a short time ago, the whole of the 250 instruments, which comprised one of the finest and most modern installations in the English postal service, were lost, the damage representing some thousands of dollars. For the past twelve months the work of substituting the accumulator system in place of the old battery system has been in progress, and now the obsolete system will have to be used for another year until the accumulators can be restored.

The Russian authorities are displaying remarkable energy in connection with the utilization of Popoff's wireless telegraphic system. All the lighthouses in the Black Sea are to be provided with this apparatus, and several stations are to be erected on the shore, so that communication may be maintained between the shore, lighthouses, and the warships within the radius of the electric waves. Two hundred complete installations of the apparatus were recently dispatched to Vladivostock and Port Arthur, and the work of fitting out the Russian warships in the Pacific is to be carried on with all possible celerity. The two ports are also to be connected by the establishment of intermediate stations along the Korean coast.

Mr. K. W. Hedges, of London, has recently patented some improvements in connection with lightning conductors. By his process, all the joints in the conductors are effected by a fusible or plastic metal, poured into a mould which has been placed around the parts to be joined. To insure perfect contact between the joints, he recommends that the mould should constitute a kind of clamp, thus forcing the plastic metal upon the parts of the conductor joints. He also fixes a lead protecting sheath round the conductor at the approximate point at which it enters the earth. Earthing is attained by a plate, or in the event of the ground being dry, by a tube driven deeply into it, and closely packed with carbonaceous material.

A new electricity meter has been patented in London in which the conventional balance spring is substituted by an electro-magnetic device to bring the escapement wheel to the central position. This wheel has a number of wires diametrically attached to it, and is surrounded by a coil through which passes the current to be measured. The rapidity of the oscillation of the balance wheel to a certain extent is proportional to the current. Should an extra powerful current happen to traverse the coil, or should the current be suddenly increased in voltage, auxiliary devices are provided to prevent the balance wheel when near the central position remaining stationary at that point. These secondary appurtenances also serve to set the balance wheel in motion with a small current. In other respects the appliance resembles the ordinary type of meter.

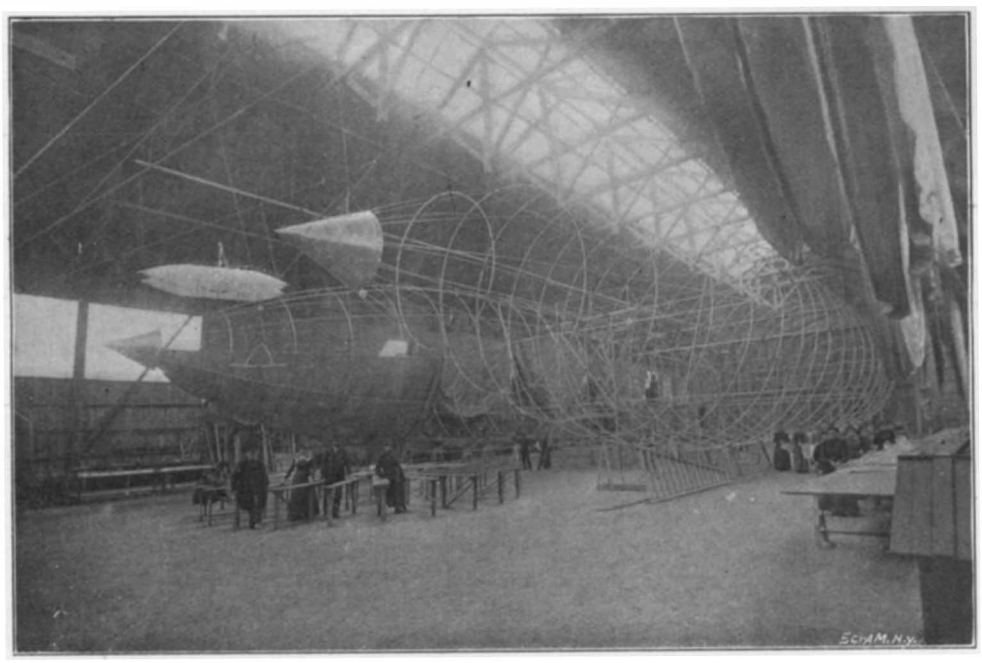
THE ROZE DIRIGIBLE AIRSHIP.

The competition for the Henri Deutsch prize of $20,000 for dirigible balloons promises to be of great interest, and next spring will, no doubt, see the first contest, as at present no less than three dirigible balloons are being constructed at Paris, and will probably be finished before the end of the year. These are the balloon of M. De Santos-Dumont, which has already been described; the "Thermosphere" of M. Emmanuel Aimé, secretary of the Aero Club; and the "Aviateur," which is now being constructed by M. Roze at Argenteuil, in the vicinity of Paris. M. Roze, who has been occupied with the subject for a number of years, has finally decided upon a type of dirigible balloon with which he expects to solve the problem. He employs the principle of a balloon heavier than air which is lifted by the ascensional power of two horizontal helices driven by petroleum motors and propelled by two vertical helices. The balloon is thus able to rise or descend at will, and may be placed in the most favorable region to take advantage of air-currents. The idea thus approaches somewhat the ideal conditions of a bird's flight. The apparatus consists essentially of two immense cigar-shaped balloons, side by side, joined by a framework in the middle, which supports a car containing the propelling and steering devices. The total weight, including eight persons, is 6,800 pounds, and the ascensional power of the balloons is calculated so as to make the whole apparatus 220 pounds heavier than air. Above the car is a parachute of special construction, which also serves the purpose of an aeroplane. The engravings and diagram show the general arrangement of the apparatus; the two cigar-shaped balloons are of considerable size, being about 140 feet long and 22 feet in diameter in the middle. They are constructed upon a skeleton frame of aluminium tubes and rods, made up of a series of circles and longitudinal brace-rods; at each end is a point made of sheet aluminium. This frame is very rigid, and at least 15,000 feet of tubing and rods have been used in its construction. The framework is covered with varnished pongee silk to form the balloon.

Each of the balloons is divided into six compartments by transverse partitions, and from the middle part down the interior is provided with a double bottom, to allow for the expansion and contraction of the gas without deformation. The different compartments are connected by means of a series of tubes having automatic valves of special design, so as to allow the proper distribution of gas without a brusque displacement; the compartment serves also for safety in case of rupture. The tubes which join the two balloons allow the passage of gas from one to the other, and thus the equilibrium of the system is maintained. The framework in the middle, connecting the two balloons, is made of aluminium tubes and rods, and supports the car below, with its propellers, and, above, the parachute, which is on a level with the top. One of the engravings shows a rear view of the car, which is divided into an upper and lower part; it is made of light wood and aluminium. The lower part will hold eight persons seated, including the aeronaut, whose station is in front, where he has at hand all the controlling devices. A light wood partition forms the upper floor, which is to contain the motors; the top of the car is formed of a light framework covered with canvas, which comes down to a point at each end, giving the whole a fish-shaped appearance. Two or more gasoline motors of light pattern are to be used, giving a total of 20 horse power—10 for the lifting and 10 for the propelling helices. The motors are to be coupled together, or may be used separately in case of accident. There are two propelling helices, one in front and one in the rear of the car; the latter, with the vertical rudder, may be seen in one of the views. The propellers are formed of aluminium tubing over which varnished canvas is stretched; they revolve at the rate of 200 revolutions per minute and will displace about 450 cubic yards of air per second; M. Roze thus counts upon a speed of 40 to 60 miles an hour in calm weather. Above the car are placed the two ascensional helices; one of these in construction may be seen in the foreground of one of the views. They have been calculated to overcome the weight of the balloon, with a sufficient reserve force to lift it to any desired height, and the position of the balloon in space is thus quite under the control of the aeronaut, who may place himself in the most favorable zone.

There are two of these ascensional helices, carried upon vertical shafts spaced each about 10 feet from the center of the car. There are four horizontal rudders, two in front and two in the rear; one of these will be noticed at the side of the car. Above the helices is placed the parachute, at about the same level as the top of the balloons; it consists of a light framework (see diagram) from which hang a number of blades formed of silk stretched on an aluminium frame; these take a vertical position when the balloon mounts, and when it is propelled forward they are inclined toward the rear. In case of accident, when the balloon descends, or when in other cases it is desired to use the parachute as an aeroplane, the hanging vanes come together at the top and form a large surface, and the descent is thus gradual. Besides, the position of the vanes may be governed at will by a system of cords, and an aeroplane may thus be formed at any time, and the ascensional helices disconnected; all the force of the motors is then available for the propulsion. The disposition of the car has the advantage of keeping the mechanism at a distance from the bottom, and there is less danger from shocks. The bottom of the car is about 3 feet above the bottom of the balloons; in case these should descend upon the water, the system would float and the car would be still out of water.

Mr. Roze has constructed a small model about 5 feet long in which the helices are moved by clockwork; it is suspended from a balanced lever, and is made to go through the different evolutions, from which favorable predictions may be made for the large balloon. It is expected that the first experiments will be made toward the end of the year if the weather is favorable.



FRAMEWORK OF THE ROZE TWIN AIRSHIPS.

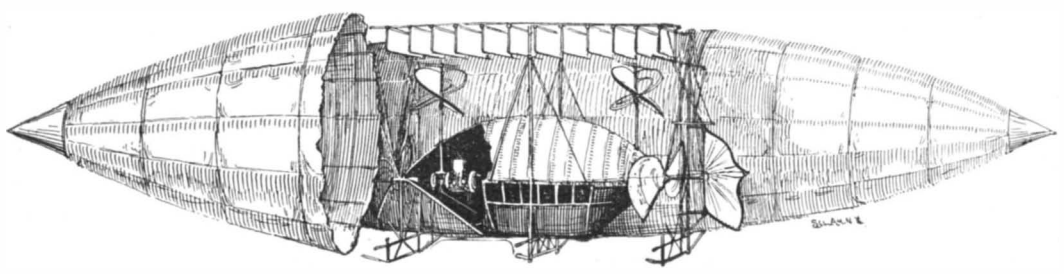
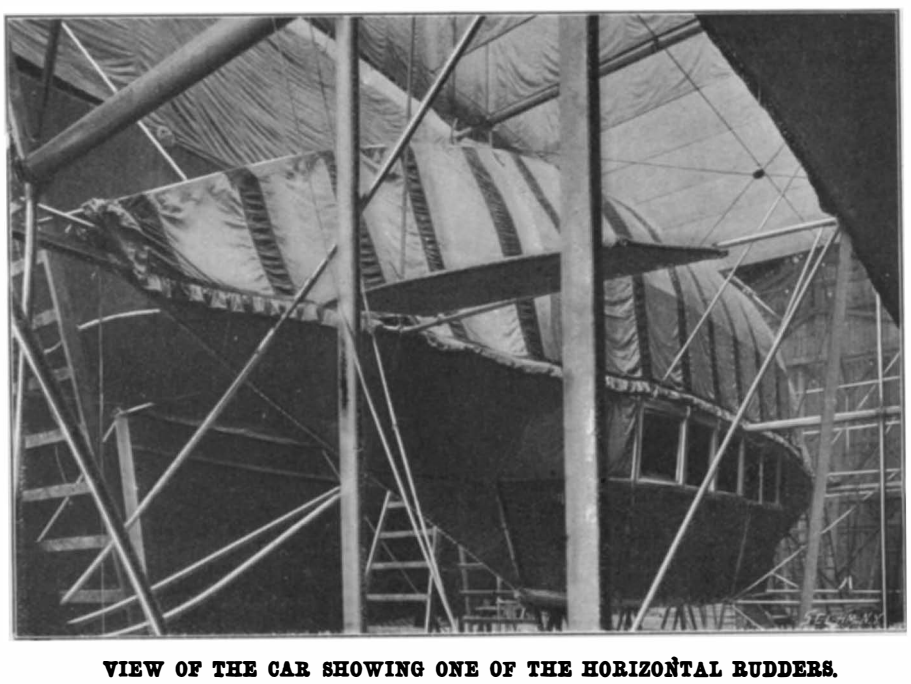
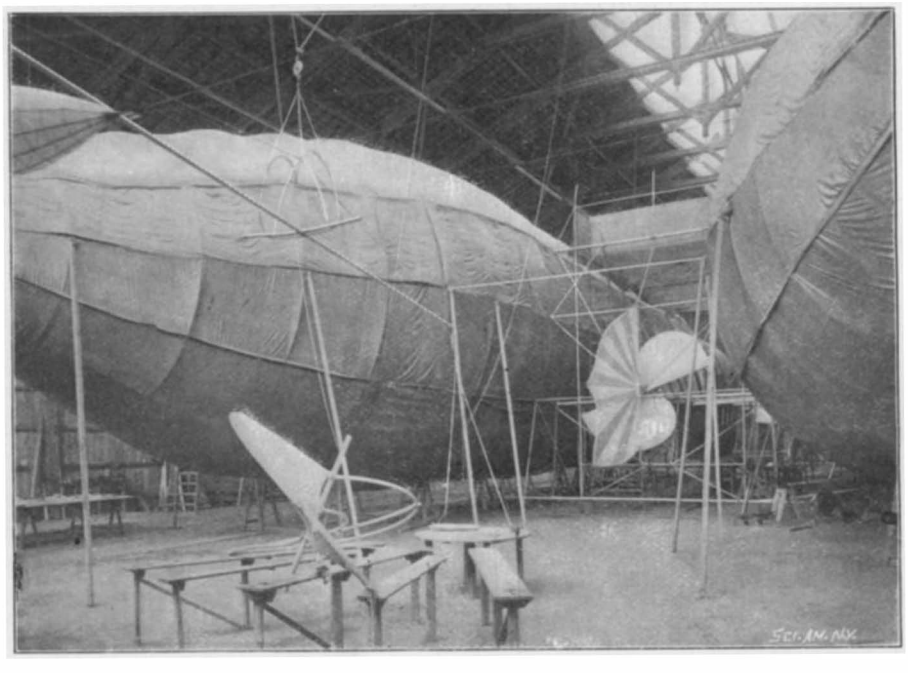


DIAGRAM SHOWING DETAILS OF CONSTRUCTION.



VIEW OF THE CAR SHOWING ONE OF THE HORIZONTAL RUDDERS.



REAR VIEW SHOWING REAR HELICE AND VERTICAL RUDDER.

Arsenic in Beer.

In England the victims of arsenical poisoning from drinking beer now number more than sixty dead and one thousand ill, Manchester being the center of the trouble, and the places affected are usually within a hundred-mile radius of that city; but the panic has spread over the entire country. It has been found that the cause of the poisoning is arsenic in the sulphuric acid used in the manufacture of glucose, which the English brewers employ in making cheap beer in place of malt and hops. The poison has thus far been traced to only one establishment, which supplied sugar for several breweries in the Midlands and the North. The commercial sulphuric acid used in England is largely made of pyrites, which comes from Spain, and there is always a trace of arsenic in it. It was thought there was an undue amount in the lode from which the supply came in this instance. An analysis of some of the beer sold in public houses showed that it contained sufficient arsenic to kill any regular drinker. Hundreds of thousands of gallons of beer have been poured into the sewers of Manchester by brewers and retail dealers. It is probable that there will be a governmental inquiry, and that there will be legislation providing for the use of malt and hops instead of cheap and deleterious substitutes.

A FRESCO which is attributed to Giovanni Bellini has been discovered in the church of the Frari in Venice.

DISAPPEARING DEMON.

BY W. E. ROBINSON.

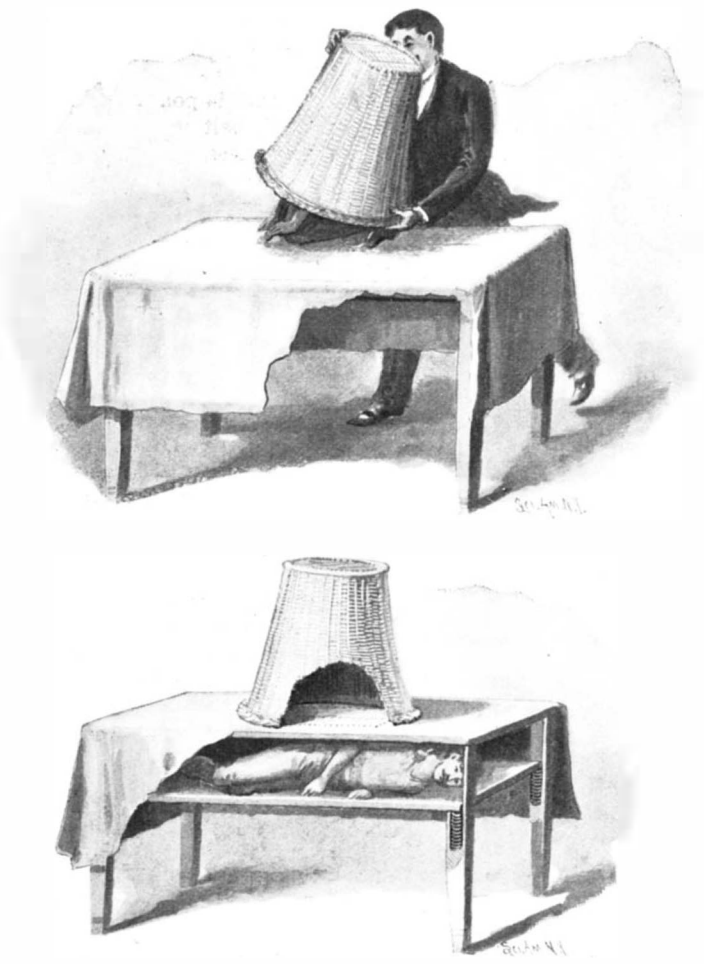
An excellent trick which never fails to please is known as the "Disappearing Demon." A couple of very clever acrobats and contortionists have been mystifying both continents with acrobatic feats and wonderful posturings, and then end their performance with a unique disappearing and appearing act. The only piece of apparatus which they have occasion to use is what appears to be an ordinary kitchen table, devoid of cloth. One of the performers suggests that they set the table for dinner. The cloth is spread over the table, coming some ten inches below the top. A dispute then arises who shall cook the dinner. Finally, one of the acrobats, who is dressed as Mephisto, jumps upon the table to get away from his companion, who follows him with a cone-shaped wicker basket, which he claps over his comrade's head and body, hiding him completely from view. In a few seconds the pursuing acrobat kicks over the cone, and the demon has disappeared. The cone is again placed upon the table, and immediately lifted, and it is found that the demon has returned. The trick can be readily understood by reference to our engravings. The table has a double top, the upper one being made fast to the legs and containing a well-concealed trap. The lower one is movable, working up and down in grooves in the table legs. It is kept in its normal position against the real top of the table by means of spiral springs in the hollow legs of the table. The cloth is slit on three sides of a square, and the other side is loosely basted, so that one pull on the thread will disjoint or free it. When the demon is covered over, he pulls out the thread in the cloth and passes through the trap in the table top, the lower part of the double top sinking down under the performer's own weight. During the time when he is lost to the view of the audience, he lies flat between the two table tops, and close to the trap. Of course, when the cover is removed, he has apparently disappeared. He makes his appearance in the reverse way.

Fish Poison.

The subject of fish poisons has for some years past attracted attention among chemists, and a useful contribution to the subject has just been completed by a corresponding member of the Pharmaceutical Society, Dr. M. Greshoff, the Director of the Chemical Laboratory at the Colonial Museum, Haarlem. It forms Part XXIX. of the Mededeelingen uit 'Slands Plantentuin, as published in Batavia. A good deal of the work was done in the celebrated Botanical Gardens at Buitenzorg, in Java, where Dr. Greshoff worked for some time. This volume is the second that has been issued, and the two form a complete résumé of all that is known on the subject, economical, botanical, and chemical. The poisonous action on fishes seems to be due chiefly to the following substances: Prussic acid, saponin, cumarin, cytisine, and andromedotoxin, although there are others, such as picrotoxin, derrid, and the acrid principles of the Euphorbiaceæ and Ranunculaceæ.

Antiseptic Properties of Bile.

A few years ago it was supposed that the bile had a considerable antiseptic power, and that one of its functions consisted in modifying the intestinal fermentations; later on, however, bacteriological research showed that the bile had no antiseptic power, but, on the contrary, it was in most cases an excellent medium for the culture of different microbes. But although the bile is not antiseptic, it acquires, under certain conditions, antitoxic and vaccinating properties. Robert Koch found that the bile of animals who had succumbed to the bovine pest could be used for the inoculation of other animals to protect them from the disease. The recent work of F. Neufeld has established a new property of the bile, namely, a bacteriolytic power toward the pneumococcus. If 1 part of rabbit's bile is taken and mixed with 10 or 20 parts of a bouillon containing the pneumococcus, it is found, upon examining the liquid in suspended drops, that at the end of a few minutes the contours of the pneumococcus lose their sharpness, becoming less and less visible, and finally disappear completely, being dissolved in the liquid; this action requires, in ordinary cases, about three or four minutes, but sometimes lasts as long as fifteen to twenty minutes. The rapidity with which the solution takes place varies, besides, with the more or less fluid state of the bile and the quantity of culture introduced; the bile may dissolve up to 300 times its volume of culture. The action is about the same at the ordinary temperature and at 38° C.; but is slower at 1° or 2° above zero. The dissolving of the pneumococcus does not involve the destruction of the vaccinant substances contained in the body of these micro-organisms; in fact, a hypodermic injection of bile given to a rabbit, and having previously dissolved a culture of pneumococcus, gives it immunity, or at least increases considerably its resistance to this form of infection. The bile seems to act only against this particular form of micro-organism, and leaves intact the other pathogenic bacteria (typhus bacillus, streptococcus, diphtheria bacillus, etc.) This property is possessed not only by rabbit's bile, but in less degree by the human bile and that of different animals.

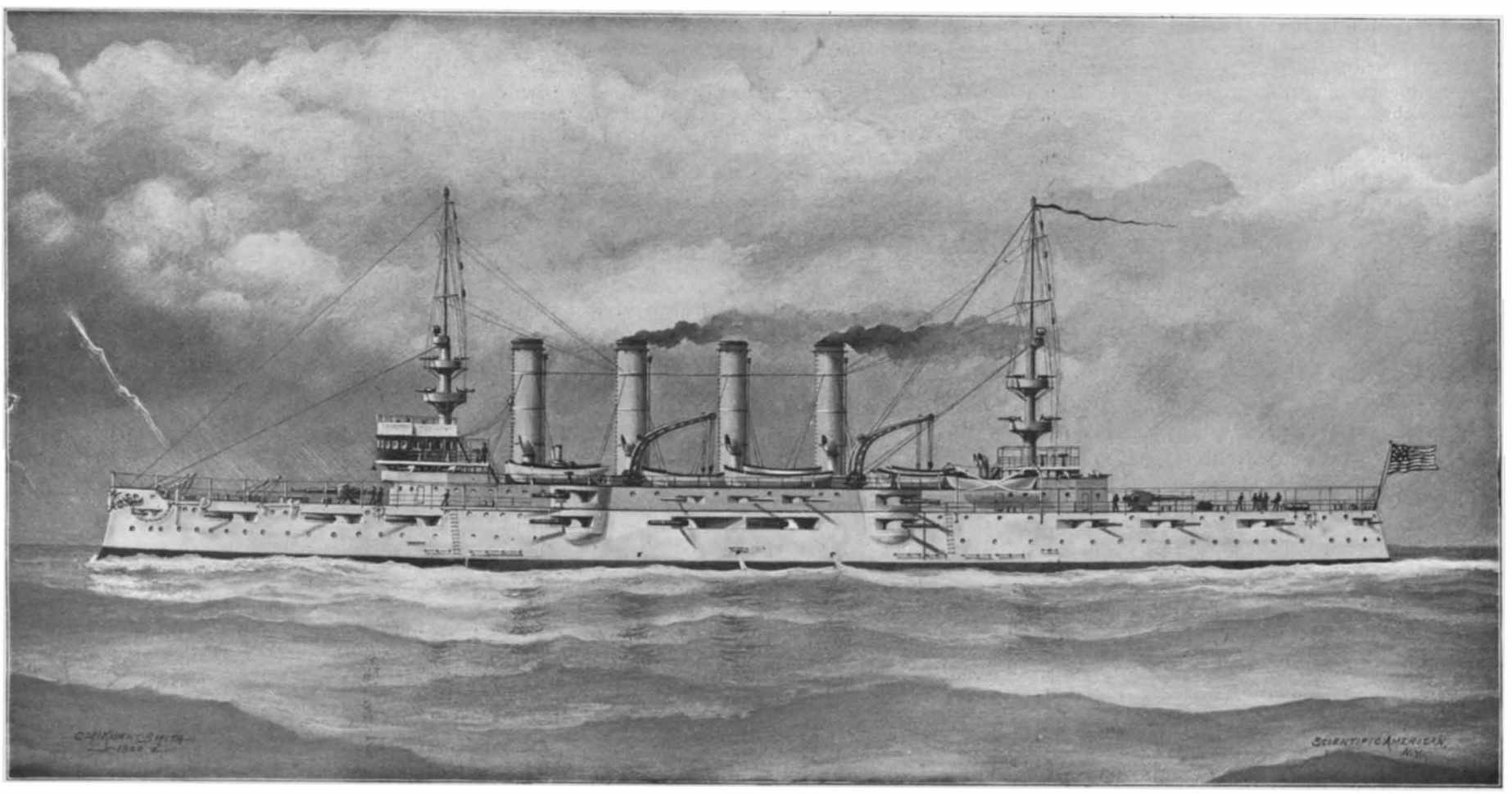


THE DISAPPEARING DEMON.

THE PROTECTED CRUISERS OF THE "ST. LOUIS" CLASS.

A point has been reached in the development of the new United States Navy in which we not only have ceased to follow the lead of other navies, but are producing original designs of ships and novel details which are being followed by foreign constructors. It is true that in size the United States Navy stands fourth among those of the world, but in design, material, equipment, and efficiency, it is the equal, if not the superior, of any other navy. This result is due largely to the ability and energy of the Bureau of Construction and Repair, which, under the Chief Constructor, Rear-Admiral Philip Hichborn, has been responsible for the design, construction, and maintenance in a state of efficiency of our new navy. The latest products of this Bureau are fourteen vessels, whose construction has recently been authorized, namely, five battleships, of about 15,000 tons displacement, six armored cruisers, of about 14,000 tons displacement, and the three protected cruisers which form the subject of the present article, of a little under 10,000 tons displacement.

The Protected Cruisers, to be named the "St. Louis," "Milwaukee," and "Charleston" (the latter to continue the name of the 3,700 ton vessel wrecked November 2, 1899, off Kamiguin Island in the Philippine group), compare favorably with their class in other navies. In fact, so closely do they approach the type of second-class armored cruisers that they might easily be



NEW UNITED STATES PROTECTED CRUISER "ST. LOUIS"—ALSO "MILWAUKEE" AND "CHARLESTON."

Displacement, 9,700 tons. **Speed,** 23 knots. **Bunker Capacity,** 1,500 tons. **Armor:** Side armor and partial belt, 4 inches; conning tower, 5 inches; gun positions, 4 inches; protective deck, 2½ inches. **Armament:** Fourteen 6-inch 50-caliber rapid-fire, eighteen 3-inch 50-caliber rapid-fire, twelve 3-pounders, twenty-four smaller guns. **Complement,** 564.

mistaken for such. In an engagement they would prove themselves a match for some of the armored cruisers of other navies. A comparison of their principal data with that of the British "Monmouth" class will demonstrate their value.

	United States. "St. Louis," "Milwaukee," "Charleston."	Great Britain. "Monmouth," "Essex," "Kent," "Bedford."
Length on load waterline	424 feet.	440 feet.
Breadth, extreme	66 feet.	66 feet.
Trial displacement	9,700 tons.	9,800 tons.
Mean draught at normal displacement	23 feet 6 inches.	24 feet 6 inches.
Engines, twin-screw, I. H. P.	21,000	22,000
Speed	22 knots.	23 knots.
Normal coal supply	650 tons.	800 tons.
Coal bunker capacity	1,500 tons.	1,600 tons.
ARMAMENT.		
	Fourteen 6-inch R. F. guns.	Four 6-inch R. F. guns, in turrets.
	Eighteen 14-pdr. R. F. guns.	Ten 6-inch R. F. guns in casemates.
	Twelve 3-pdr. R. F. guns.	Ten 12-pdr. R. F. guns.
	Four 1-pdr. automatic.	Three 3-pdr. R. F. guns.
	Eight 1-pdr. R. F. guns.	Eight machine guns.
	Two 3-inch R. F. field guns.	
	Two machine guns, 0·30 caliber.	
	Eight automatic guns, 0.30 caliber.	
PROTECTION.		
Main side armor	4 inches.	4 inches, tapering to 2 inches at bow.
Lower casemate armor	4 "	
Upper " "	4 "	
6-inch gun protection	4 "	4 inches.
Conning tower and shield	5 "	
Signal tower	4 "	
Splinter bulkheads	2 "	
Protective deck	2½ "	Two decks, 1¼ inches and ¾ inch.

The act authorizing the "St. Louis" class states that these vessels shall carry "the most powerful ordnance for vessels of their class, and have the highest speed compatible with good cruising qualities and great radius of action;" all these qualifications have been embodied in the design for these vessels. The general appearance of these cruisers suggests that trite quotation: "A thing of beauty is a joy forever." "Beauty" and "joy" applied to these vessels mean easy lines, graceful exterior, speed and the ability to sustain that prestige upon the sea which has been maintained by the navy of the Republic since its origin.

The main deck of these cruisers is supplemented amidships with a covered superstructure, within which are located four 6-inch rapid-fire guns and six 14-pounder rapid-fire guns; outside the superstructure are two more 6-inch rapid-fire guns, located on the center line, one forward and the other aft. Located on the gun deck is the greater portion of the battery, consisting of eight 6-inch rapid-fire guns, twelve 14-pounder rapid-fire guns, and four 1-pounder rapid-fire guns. Sixteen rapid-fire guns are stationed on the superstructure deck and bridges, and the remainder of the battery is located in the fighting tops of the two military masts. Additional platforms are built upon the masts to accommodate the two search-lights. Electric ammunition hoists are designed to supply the guns with the greatest rapidity, making it possible to hurl against an enemy a broadside of about twelve tons of metal per minute.

The four lofty smokestacks, extending to a height of 76 feet 6 inches above the normal load waterline, provide draught for sixteen straight water-tubular boilers located in four watertight compartments, which, together with the engines, are protected by the side armor, sloping deck armor, and a twelve-foot coal bunker.

The inner bottom of these vessels extends to the under side of the protective deck; above the protective deck a cellulose cofferdam, 30 inches wide and 41 inches above the normal load waterline, extends throughout the length of the vessel.

In the construction and equipment of the "St. Louis" class, as small a quantity as possible of wood is to be used, and wherever it is used it will be electric fire-proofed. Each vessel of this class is fitted to accommodate a flag officer and staff in conjunction with the regular complement. In commission the number of officers will be 39 and the crew will number 525 men, for which are provided 16 boats, ranging from a 36-foot steam cutter to a 16-foot dinghy, and in addition to these two 12 foot punts and two life-rafts will be carried. These boats are stowed in chocks on the superstructure deck and swung out by four cranes.

All the latest and best improvements in construction and equipment are to be provided for the accommodation and comfort of the officers and crew.

The waterline belt, 4 inches in thickness, extends in the wake of the engines and boilers and magazines for over one-third of the vessel's length, and reaches from several feet below to about 3 feet above the normal waterline. Side armor of the same thickness is carried up amidships to the main deck, and extends between and includes the forward and after 6-inch guns on the gun-deck. The 6-inch guns at the four corners of the superstructure are also protected by 4-inch armor.

While we greatly admire these vessels, we must express a regret that the waterline armor was not carried up to the bow, even if some compromise had been necessary in the matter of coal or armament. This is an age of armored cruisers (i. e., ships with a complete waterline belt), and it is regrettable that these vessels should fall short of the requirements for want of the 120 feet of 2 to 3-inch armor necessary to complete the belt to the stem.

The corn-pith cellulose cofferdam at the waterline, with its water-excluding properties, will safeguard the trim and stability of the "St. Louis" against all but the smaller 6 and 14-pounder shells about as effectively as if the 2-inch belt were extended to the stem; but it will be just these very small-caliber guns that will be used to search out and cut to pieces the unprotected ends of an enemy's waterline.

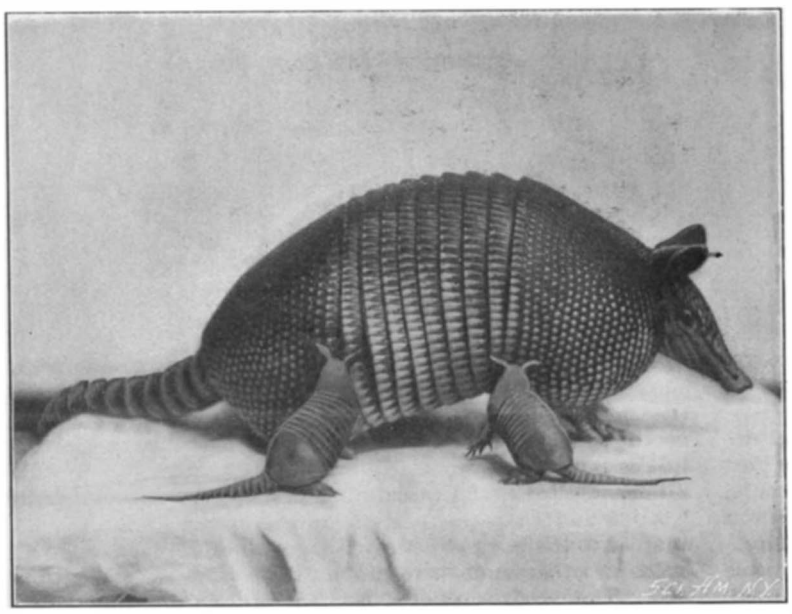
It must be admitted that the new ships, although they are not quite in the class of the armored cruisers, are nevertheless more than a match for any protected cruiser afloat.

ARMORED BURROWERS.

BY CHARLES F. HOLDER.

In the early days some of the most interesting animals were burrowers, as the glyptodon and toxodon; huge mailed creatures estimated to have been as large as a rhinoceros. South America was the home of these forms, and when the remains of a toxodon were discovered, they created no little excitement in the world of science. A rancher found the skeleton, which had rolled out of a bank. The strange head was seized upon by his boys, who, after pounding out the teeth, set up the then priceless skull as a mark, and what was left, and a few teeth, constitute the most interesting specimen in England to-day.

The glyptodon had a length of five feet and resembled an enormous turtle. The tail was long, giving the animal, with its head, a length of nine feet. All these mailed animals appear to have been enormous. Thus the genus Chlamydotherium equaled the largest living rhinoceros in size, while Pachytherium was as large as an ox. They were slow-moving creatures with little intelligence, needing the heavy armor to protect them from the attacks of the savage animals of the time.



ARMORED BURROWERS.

These giants seemed to have anticipated the curious armadillos of to-day, which are found in South America and the southwestern borders of the United States. It is difficult to imagine more interesting creatures than these armored burrowers, provided with a coat of mail jointed and so arranged that some can coil themselves up into a perfectly protected ball impervious to the attacks of almost any foe.

Armadillos are not rare in museums, but to see one alive with its young is not an every-day experience; and when I was informed that a female, owned by Edwards Brothers, of Tacoma, Washington, had given birth to three young in Pasadena, I induced the owner to allow me to photograph the family group. The young were interesting little creatures about six inches in length, and despite the fact that they were but a day old were very active; and doubtless the patient photographer, Mr. Jarvis, of Pasadena, never had such remarkable and obstreperous subjects, as it took four men over an hour to secure the accompanying picture. The mother was very docile, and displayed no affection for her young. When placed on a table on a white cloth, to throw her outlines into relief, she seemed like a stuffed specimen as far as any interest in her surroundings went; the only motion being a trembling, as though she were cold. But the two young were continually moving, attempting to reach the mother and nurse—a privilege which she had evidently denied them from the first; and the owner was trying to raise them by the bottle, to which they seemed favorably inclined. Their movements were very erratic and rapid, and when touched they at first seemed to recognize a stranger, and gave sudden leaps; but they soon became reconciled to the warmth of my hand, and would lie perfectly quiet. They were pink in color and almost perfect facsimiles of their parent; their eyes open, and the armor as hard as the inside of a man's hand and by no means as soft as one might expect. The head was very large in proportion to the body, the reverse holding in the adult.

There was something about both parent and young suggestive of swine; the peculiar snout as cold as ice, the piglike ears, and a very comical piglike trot completed the resemblance. The mother was perfectly tame, and sat in the keeper's arms in almost any position without objecting, but a strong, peculiar musky odor was particularly offensive, and would prevent the armadillo from being a popular pet. When placed upon the floor, the animal would trot around at a rapid gait, apparently not using her small eyes, but touching the snout to the floor at every step, as though to direct her course. The two adults ate three pounds of roast beef per day, and were given nothing else.

The observer in watching the animal could not divest himself of the idea that it was an automaton and wound up, so clumsy were the movements. Sometimes she stopped as though to listen, cocking her long ears upward and holding her head slightly on one side, at which time she might be standing on the tips of her toes in a most constrained and unnatural position; in a word, when the animal stopped, she did so in whatever position she happened to be in, whether flat-footed or on tip-toe. The keeper said that the animal displayed no intelligence, and paid no attention to her young. I repeatedly held the young to her nose as she trotted across the floor, but she did not appear to notice them. When placed in a box, she made convulsive leaps, falling with a crash.

To see the armadillo at its best, it should be in its home, where its burrowing powers are extraordinary. It is said that it is almost impossible to dig one out, the animal having the faculty of burrowing faster than two or three men can dig. Darwin, in referring to a South American form, states that when one was seen running along on the pampas, it was necessary literally to tumble from the horse to save it, as it would immediately begin to disappear, and before it could be grasped would often be nearly out of sight, its tail alone remaining above ground.

The hairy armadillo, according to Azara, would scent a dead horse a long way, and run directly toward it as would a hound. Instead of attacking it above ground, the armadillo would begin a burrow some distance off and come up beneath it, burrowing into it and remaining in the body until it had devoured all but the hide and bones. This species is said not to build burrows to live in, preferring the surface of the ground. When the singular Botocudos were first visited by white men, they were found to be provided with extraordinary speaking trumpets, hard as rocks and made up of facets. These were the tail armor of the largest of all the armadillos, which attains a length of two to five feet and has twelve or more movable bands. Its claws are enormous, constituting the most powerful digging armament known among animals; and in the regions where it is found, bodies when buried have to be weighted with rocks to prevent their depredations.

Nearly all the armadillos are valued as food, the flesh being described as good even from the American standpoint. The shells are used for a variety of purposes, and I have seen a very fair guitar made from one, the strings being stretched across the opening, a neck of wood having been inserted. To a certain extent the animals are scavengers. Several have been kept on one of our men-of-war to kill insect and animal pests, devouring rats, mice, and cockroaches with avidity. They are not confined to animal diet in their natural state, eating succulent roots, seeds, and plants of various kinds.

Potash Soap to Prevent Dimming of Eye-Glasses.

Constant wearers of eye-glasses, spectacles, etc., are much annoyed by the dimming of the glasses upon entering a warm room from a cooler place. It will greatly interest them to know that this evil can be obviated by rubbing the glasses with soft soap. All that is necessary is to rub every morning or before going out a little so-called green soap (washing soap, potash soap) over the whole surface of the glass, polishing it until it is bright again. The preparations, "Glasolin" and "Oculustro," offered for the same purpose at high prices, are nothing else than pure potash soap.—Die Werkstatt.

THE Prussian army is going to try barracks made of asbestos. Field Marshal Count von Waldersee has a portable asbestos house among his luggage.

V. AN INEXPENSIVE WATER MOTOR.

BY GEORGE M. HOPKINS.

A simple but very effective water motor can be made by any one according to the plan here shown, with little trouble or expense. It may be necessary to have a few minutes' work done by a tinsmith. The maker may do this if he understands soldering.

In a pine board 7 inches square and 1 inch thick, make a round hole 5 inches in diameter, by the use of a scroll saw, or in any other convenient way. To the sides of the board fit two thin boards ¼ inch thick, one on either side. In a small hole in the center of each side drive a short piece of brass tube of about ⅛ inch internal diameter, and to these tubes fit a straight steel wire so that it will revolve freely. This wire is the shaft of the motor wheel. It should be of sufficient length to project an inch beyond its bearings, to receive a small pulley.

To the center of the shaft is soldered a sheet brass disk 3 inches in diameter, so that it will run true as the shaft revolves, and to the disk is soldered a disk of brass wire gauze 30 mesh. The edges of the brass wire gauze must, as the ladies would say, be sewed over and over with a fine copper wire, to prevent it from raveling when the wheel revolves rapidly. If the workman is an adept, he may solder a ring of brass wire, say No. 18 or No. 20, to the edge of the wire cloth.

The simplest way to secure a nozzle for the wheel is to buy a cheap, small oil-can having a long nozzle, with an opening in the smaller end of about $\frac{1}{16}$ inch. This nozzle is inserted into the edge of the wooden wheel-case, as shown, and its smaller end is bent so that it forms a small angle with the wheel, with the point of the nozzle as near the wire cloth as possible without touching. To cause the wheel thus made to keep a central position in its case, pieces of the small tube before named may be slipped on the shaft each side of the wheel.

A ¾-inch hole may be made in the casing at the bottom, and provided with a short tube for receiving a rubber pipe, to carry off the waste water, and there should be a ¼-inch hole in each side near the top to admit air. The casing may be secured to the wooden foot-pieces with screws. It is desirable to make the casing impervious to water. To do this, the various parts may be boiled in hot paraffine for ten minutes. If it is found difficult to secure paraffine in bulk, a pound of paraffine candles will furnish enough for this purpose. The inflammable nature of paraffin should be kept in mind, and a cover should be provided for the vessel in which it is melted, so that it may instantly be extinguished by the cover should it become ignited. The metal used in the construction of this wheel should be of brass, excepting the shaft. The screws with which the casing is put together should be brass. The top of the oil-can is cut off to form a part of the coupling for receiving the rubber pipe leading from the wash-bowl faucet to the motor.

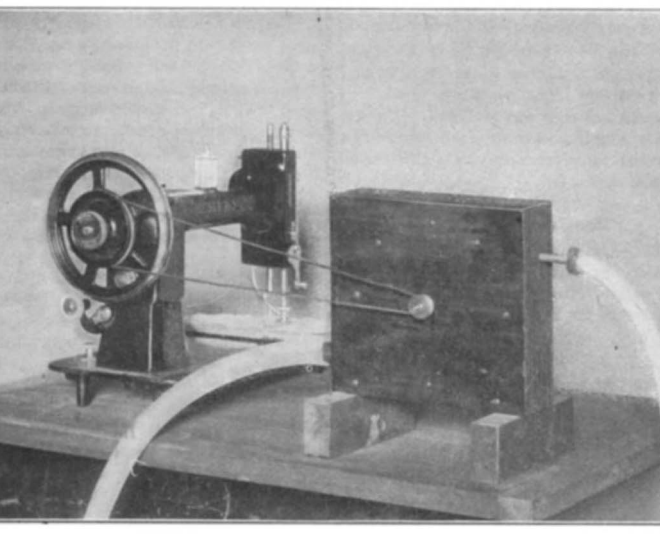
To prevent the checking of the wooden parts of the motor, the parts should be arranged with the grain lying in the same direction.

With sufficient water pressure, this motor will make from 1,500 to 2,000 revolutions per minute. With a very flexible cord belt—a leather shoestring, for example—it may be made to drive a light sewing machine, fan, or any other machine requiring a small amount of power.

If more power is required than can be secured by one water jet, additional nozzles may be distributed around the wheel, or more wheels may be placed on the same shaft, but nothing will be gained unless the water pressure is maintained. The pressure should be from 25 to 40 pounds per square inch.

In a small high-speed motor of the class here described, the full power is realized only when it is provided with a very small pulley connected by a very flexible belt with a large pulley on the machine to be driven.

It is obvious a non-corrosive metallic case would be better than a wooden one, and the metal one is advised when the builder has conveniences for making a casing of that kind.



SMALL WATER MOTOR.

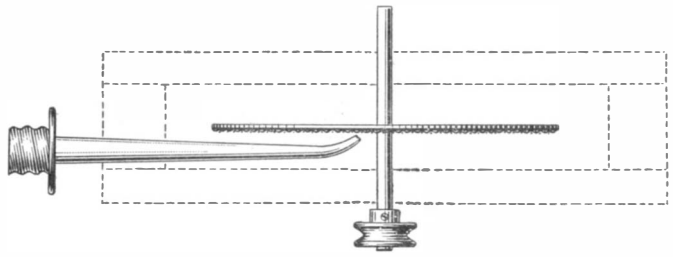


DIAGRAM SHOWING POSITION OF NOZZLE.

MOTOR DRIVING SEWING MACHINE.

The White Sands.

Perhaps of all southern New Mexican wonders, that which is known locally by the name of the White Sands is the most remarkable and beautiful—let us add, one of the most financially valuable also.

Imagine scaling a mountain in the Arid Belt, wherein lakes and rivers of any importance (with an apologetic bow to the Rio Grande) are conspicuous by their absence, and beholding against the cloudless blue of the horizon a line of silver breakers tossing before a fine head wind. Such, as viewed from a distance, are the locally famous White Sands. In reality this silver sea is a vast bed of purest gypsum, about 60 miles in length and from 5 to 20 in width. It lies in the San Augustin Plain, 60 miles south or so of an extinct volcano, whose lava stream flows to within a moderate distance of it. There are other gypsum deposits in the Territory, but none so important or so extensive as this one, which may be looked upon almost in the light of a phenomenon. Little or nothing seems to be known of it, however, in public institutes of scientific or other research; in fact, the curiosities and resources of this section all share pretty much the same fate. Even the mines, fabulously rich as they are in various ores, receive no attention.

The latest report of the United States Geological Survey mentions, for instance, but one of the several turquoise mines, and that one of the least important—whereas the New Mexican turquoise has long held a place in the front rank in the European markets, and more recently in those of New York. The so-called sand hills of this great gypsum bed are none of them over 40 feet in height; yet on a near approach they resemble some mountain region clothed in eternal snows and broken into gorges and cañons of indescribable beauty and variety. The winds of the plains keep these sands so constantly in motion that no living thing takes root there, although along its edge trees and plants find nourishment. It may be presumed that some profitable use will one day be made of this valuable deposit. A railroad now runs to within 20 miles of it, and other roads are in prospect.

On the western border of the gypsum deposit, and extending for about five miles in length by one mile in width, is what is generally supposed to be the bed of some vanished lake or river. Here the deposit of carbonate and sulphate of soda, and borax, appears to be of unknown depth, and the water found from two feet below the surface to 30 feet (which is as far as exploration has hitherto been carried) is heavily mineralized, not only with the above ingredients, but with chloride of sodium also.

The Dissolution of Bones by Bacteria.

It is considered certain that bacteria play an important part in the dissolution of bones, so that if rapid dissolution is desired, it follows that the bacteria should be afforded every opportunity of doing their work. This may have some bearing upon our methods of the disposal of the dead, says The London Lancet. The action of bacteria is not likely to be facilitated by burying bodies at a comparatively great depth beneath the surface. Some recent experiments have shown that when sifted bone-meal was inoculated with various bacteria, and kept wet, a remarkable resolution of the constituents of the bone, including the inorganic as well as the organic matters, took place. The latter resolved themselves, as might be expected, into simpler compounds of the type of ammonia, but the most curious results consisted in the fact that the soluble phosphate of lime was converted into soluble phosphoric acid. The experiments were confirmed by utilizing oats grown in large pots with bone meal and inoculating with different bacteria. The yield of oats was far greater than when the bone meal was inoculated in this way. Several species of bacteria were employed with results which varied widely. As a rule the organic substances which act as poisons in the human body are of a very complex nature, and as they are resolved into simpler ones their toxicity diminishes and finally disappears. In the putrefaction processes, the organisms concerned are rapidly breaking down complex toxic substances into simpler innocuous products. Bacteria, however, in certain diseases, may elaborate poisons of a highly complex constitution. Thus we have two great classes of organisms from the point of view of the healthy human subject, the benevolent and the malevolent.

A LOCOMOTIVE recently ran off a bridge over the St. Quentin Canal, near Paris, and fell into the water. It was found impossible to raise the locomotive, as the space was so confined, so divers passed chains around it, and these were attached to beams. The load was then raised by means of screw supports, blocking being introduced as the work proceeded, to guard against a possible breakdown. The locomotive was lifted 14 feet, so that a sand-laden barge could be run underneath. The engine was then lowered and taken away; five days were consumed in doing the work.

December Building Edition.

The thirtieth volume of the BUILDING EDITION ends with the December number of this periodical, and certainly no issue of this journal was ever handsomer than this number. The cover is devoted to a colored illustration of a Spanish-American house at Pasadena, Cal. The first page engraving consists of a large reproduction of Donatello's pulpit of San Lorenzo, Florence. "Ochre Court," Newport, R. I., the residence of the late Ogden Goelet, Esq., is the subject of three large engravings. This is one of the masterpieces of the late Richard M. Hunt. A choice selection of modern suburban houses is given.

The Current Supplement.

The current SUPPLEMENT, No. 1303, opens with an article on "Direct-Connected Railway Generators," in which large machines are illustrated in detail. "Contemporary Electrical Science" is a series of short notes on electrical matters. "The Origin and Progress of Scientific Societies" is an address by Sir John Evans. "The Paris Exposition of 1900" is by Carl Hering. "Elephant Hunting" is an extremely interesting article. "Driftwood" deals with floating timber, and gives most interesting facts. "A New and Simple Method of Making Telescope Objectives" is by Edmund M. Tydeman, and is accompanied by working drawings. "The Great Sea Serpent of the Garden of Acclimatation" is illustrated by two engravings. This issue contains the usual Consular Reports and Trade Notes and Receipts.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

DRY-BATTERY. — ERNEST MEYER, Boulevard de Clichy 60, Paris, France. About the centrally-located negative electrode, a depolarizing mass is located. A positive electrode surrounds the depolarizing mass. A layer of peat fiber or moss is interposed between the cloth cover and the positive electrode and is impregnated with an exciting liquid. A filling of plaster contains some of the exciting liquid and extends at the top of the battery between the electrodes. The compactness, simplicity of construction, and high efficiency of this battery are noteworthy.

Gas-Generating Machines.

ACETYLENE-GAS GENERATOR.—JAMES WALTON, Phœnicia, N. Y. This apparatus comprises a gasometer and a generator connected by a valved pipe. A bracket is carried by the gasometer-bell, from which bracket a rod projects downwardly, provided at its lower end with an arm. A chain or cord is secured to an arm of the pipe-valve and has its ends secured to the bracket and arm, so that the rise and fall of the bell will close or open the valve in order to control the generation of gas. The action is automatic. Care has been taken to provide means for cooling the gas before distribution.

ACETYLENE-GAS GENERATOR.— WILLIAM H. MCGOLDRICK, San Antonio, Tex. The generator and gas-holder in this machine are combined in one apparatus comprising a tank in which a bell is mounted to move vertically, and has a generator-dome consisting of inner and outer walls separated to form a water-space. A pipe leads from the interior of the dome through the water-space to the interior of the bell above the water-level. A vent is connected with the pipe and controlled by a valve in the pipe. A generator-cylinder is extended upwardly from the bottom of the tank. A jacket of water surrounds the bell and the cylinder. The pressure of gas in the bell forces the water downward in the bell, causing it to rise at the outer surface and to pass through the feed pipe to the generator-cylinder.

ACETYLENE-GENERATOR.—AUGUSTUS F. SHRIVER, Arbuckle, Cal. The generator-cylinder is arranged on the lower portion of the gasometer. In the generator is a spray-pipe connected with a valved supply-pipe. From the stem of the valve an arm is extended, the free end of which is adapted to be engaged by a cam-shaped projection on the top of the gasometer-bell. A curved arm, attached to the bell and projected over the cam-shaped projection, is adapted to engage the arm as the bell moves downward. The rising of the bell closes the valve of the feed-pipe; the falling of the bell opens the valve.

Railway Appliances.

LIFE-GUARD FOR TRAM-CARS. — WILLIAM T. WATSON, Victoria, British Columbia, Canada. The bed of the car-fender is divided into two parts hinged together and connected by means of chains with a frame normally stationary. The two parts are yielding; the force of a shock is further broken by a rubber buffer and by mounting the front bed so that it can slide rearwardly against the tension of springs. The invention is an improvement upon a similar contrivance devised by Mr. Watson.

Vehicles and Their Accessories.

VELOCIPEDE.—ERNST H. NEUBERT, Independent Hill, Prince William County, Va. The inventor has devised a velocipede which can be driven by the hands of the operator and in which the grips held in the hands may be moved to set the clutch devices into and out of adjustment to key the wheels upon the drive-shaft. An adjustable platform forms a support for the operator.

SEAT-COVER.—ARTHUR B. JONES, Lincoln, Mass. The cover is primarily designed for use on single seats—such as are employed on mowers and vehicles—and is arranged to be quickly folded or extended. The seat-cover frame for supporting the top comprises a curved base having hook-bolts whereby it may be fastened to a seat, and a vertically-disposed bearing. Upwardly-extending braces are secured to the base and have a clamping-bolt at their junction. A slotted standard receives the clamping-bolt and is fitted in the bearing of the base. A frame for the top is secured to the upper end of the standard and has braces connecting therewith. Adjustable straps are arranged to connect the upper end of the standard with the seat.

Mechanical Devices.

EDUCATIONAL DEVICE. — THOMAS L. MARTIN, Lewisburg, Ky. The invention is adapted for use in teaching writing, spelling, arithmetic, the fundamental principles of languages, or any subject that can be taught by copying. The device consists of a main frame; ribbon-winding rollers which are geared together; and a supplemental frame hinged to the main frame, so that it can be raised as required. Guide-rods are arranged at the front end of the supplemental frame, one guide-rod being higher than and in the rear of the other. A ribbon passes over the rolls and back to the winding-rollers. Upon the ribbon the words or signs to be copied are printed. The device saves the teacher much time and trouble.

CONVEYER.—JAMES W. BARNEY, Kansas City, Mo. This invention relates to a conveyer adapted particularly to the work of transporting brick from one point to another, particularly from kilns to a railroad, the invention comprising a hauling device having carriers adapted to receive the brick and arranged to run on trackways of novel form. The invention further comprises a novel manner of arranging the conveyer-runs so that they can be connected in various ways to carry the brick from any one of a number of kilns.

HOSE-WASHER. — JOHN J. KRESS, Perth Amboy, N. J. The purpose of the invention is to provide a washer of simple construction, which will thoroughly wash and clean the hose of fire-engines. In a boxing comprising two separable sections, two cylindrical brushes are superimposed. Forward of the brushes feed-rollers are superimposed. The brushes and the rollers are geared together. Water inlet and outlet pipes are provided. The boxing having been filled with water, the machine is set in motion. The hose as it is fed through is scraped by the brushes. The surplus water is squeezed out by the rollers.

STREET-SWEEPER.—CHARLES Z. O'NEILL, Manhattan, New York city. The object of the invention is to provide a new and improved street-sweeper, simple and durable in construction and very effective in operation. The machine is arranged thoroughly to sweep the dirt from the street-surface into the buckets of an elevator, which in turn delivers the sweepings into a wagon or cart, with the rear end of which the sweeper is removably connected. Upon moving the vehicle forward, the sweeper is dragged along to sweep the street and to deliver the sweepings to the vehicle-body. When the body is loaded, the sweeper is detached to repeat the operation.

GRATE-BAR. — GEORGE S. SERGEANT, Greensborough, N. C. The grate-bar is formed in sections which are so connected at their ends or joints as to form a self-supporting connection at such point, thus avoiding the necessity of any cross-bars or similar supports between the opposite ends of the grate-bars.

AWNING FOR MINE SHAFTS OR TUNNELS. — BENJAMIN B. WHEELER, 934 Fifteenth Street, Denver, Col. The drip of water from the roofs of mines and tunnels is a serious annoyance to miners and workmen and is a constant source of danger to health. Mr. Wheeler has devised a drip-averting awning which is light, conveniently portable, and cheap, and which can be easily and quickly put up or removed. The awning consists of two sets of telescoping tubes, each tube having a pointed outer end to engage the tunnel-wall. Screws clamp the two tubes of each set together. The awning has hems to receive the tubes.

WATER-STOP OR GATE. — WALTER S. FISHER, Artman, Colo. This invention is a water-stop in the form of a gate for use in ditches such as are employed for purposes of irrigation. The water-stop comprises a main plate on which are extension wings projected and retracted by lever devices. These lever devices are pivoted independently of and connected with the wings. By these means water may be stopped at any point in ditches of different widths within the range of the stop. The stop can be easily handled and applied and removed by a boy or man. Moreover, the stop can be handled whether or no the ditch contains water or is empty, and avoids destroying the level of the land.

Miscellaneous Inventions.

RUNAWAY-HORSE CHECK.—CHARLES E. WILLIS, Manhattan, New York city. By means of this novel device, a runaway or fractious horse is instantly subdued, and made tractable, by a very slight pull upon a check-rein within convenient reach of the driver. The check-rein operates a leather-covered tongue or projection set within the throat-latch and acting, when pulled, at right angles with and directly upon the wind-pipe. The arrangement is simple, inconspicuous, and perfectly harmless to the animal, thereby doing away with the often cruel curb-bit, and can be readily attached to any bridle for either riding or driving, and without detracting from the appearance of either the horse or harness.

FEED-BOX. — ROBERT C. JARVIS, West Pullman, Chicago, Ill. The feed-box is so constructed for a team or for a single horse that it can be readily attached to the body of an animal and held in convenient position for feeding or be quickly secured to a pole or tongue or detached therefrom. In the box, feed may be packed and stored and the box be used as a seat when not needed for feeding the horse. The box can be attached to the body of the vehicle like an ordinary seat.

RECEIVER FOR DISCHARGED SHELLS. — CHARLES H. DIETERICH, Cooperstown, Ill. The receiver consists of a frame arranged for attachment to a gun. To the frame, members are pivoted capable of assuming a parallel position or a position at an angle to each other. A bag or net is attached to the members for the purpose of receiving the ejected shells. The device can be used with any repeating gun from which the shells are ejected from the side portion of the frame.

NECKTIE-RETAINER. — THEODORE S. WOOLF, Brooklyn, New York city. The retainer is made of a single piece of metal and embraces a receiving member for a collar-button, a locking member for the button, and cheek-sections which carry spurs serving to fasten the device to the shield of the tie.

Designs.

AXLE-SHIELD.—GILBERT Y. LOWE, Washington, Ga. The inventor has designed a shield which is intended to prevent sand from entering the space between the end of the axle and the hub of the wheel.

KEY-RING AND BOTTLE-SEAL BREAKER.—WILLIAM S. LORD, JR., Portland, Me. The key-ring and bottle-seal breaker is essentially heart-shaped, the apex being a plate or web.

BOTTLE.—GEORGE W. and HERMAN F. KLUMPP, Manhattan, New York city. The body is enlarged at its central portion; and the neck terminates in a bulb-like upper end.

WRAPPING-PAPER. — GEORGE A. C. GOETTING, Manhattan, New York city. The inventor is a druggist who has devised a paper which is to be used in wrapping up poisons. The paper is printed with skulls and crossed bones; and the words "poison" appear beneath the skulls and crossed bones. The paper should find its way into every druggist's shop.

PLATE.—CHARLES J. SEITER, Manhattan, New York city. The design consists of a group of rabbits eating cabbages.

BOTTLE.—CHAUNCEY J. KILMER, Brooklyn, New York city. The body of the bottle is cylindrical. The outer surface of the neck is concave at its lower end and cylindrical at its upper end. The inner surface of the neck is tapered downwardly at its upper portion and flares with a downward convexity at its lower portion. The distance between the concave and convex portions increases upwardly.

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(8008) T. O. asks: 1. I have a continuous current dynamo giving 40 amperes at 125 volts which I use for lighting purposes. I wish now to transmit 15 amperes a distance of 3 miles; what is the best way to do so with the least loss? A. You cannot transmit the direct current at 125 volts to the distance of three miles without very great loss. You should use the alternating current at high voltage for transmission. Consult the General Electric Company, Schenectady, N. Y.; or the Westinghouse Electric Company, Pittsburg, Pa. 2. How is a lightning arrester coupled to an electric light circuit? A. The mode of connecting the different lightning arresters to the line varies. The particular type you have should have its directions accompanying it, or you should write to the maker of it for instructions. Generally, there are two binding posts for the circuit through it, and one for the ground wire. 3. What is meant by ground line detecter lamps, and how are they connected to the dynamo? A. A ground detecter lamp is, as its name implies, to show the presence of a ground immediately. They are connected in a variety of ways, depending upon the dynamo and system. In the three-wire direct current system, three lamps may be put in series between the outside wires of the circuit. A wire is put to earth between the first and second of the lamps. If a ground comes on the side of the first lamp, that lamp will light to full brilliancy. If the ground is on the other side, the two lamps there will be brighter, but not lighted fully.

(8009) J. H. S. asks how to construct a water telescope. Reference is made to this instrument in Hopkins' "Experimental Science," 17th edition, page 269. What is the cost of Nicol prisms suitable? Are such telescopes on the market? If so, about what price are they? A. There are two kinds of water telescopes. The one is a watertight tube or box of wood 6 inches or so square, one end of which is open and the other end is a plate of clear glass. This is used in examing the bottom of lakes or in looking down into the water for seeing fish, or anything else. It operates by destroying the ripples which prevent clear vision below when looking upon the surface of water. The glass end of the box is pushed down into the water and the surface of the water in contact with the glass is entirely smooth, Hence one sees clearly objects at a much greater depth than without its aid. In this sense it acts like a telescope, though it has no lens or other magnifying apparatus. The other water telescope is a complete teleseope so made that the tube may be entirely filled with water. So far as we know, they are not in the market. They have been used by astronomers for determining certain matters connected with the motion of light. To this a Nicol prism may be attached for ascertaining whether the light is polarized. The Nicol prism in large sizes is very difficult to obtain at present. Small sizes can be purchased from dealers in microscopes or other optical goods.

(8010) G. J. asks the name or names of liquid that boil at 60 degrees, forming steam in the same way that water does at 212 degrees? A. We know of no substance which has its boiling point at 60° Fah. We give you a few which boil near this temperature: Sulphurous acid, 16°; hydrofluoric acid, 68°; ethylacetylene, 64°; ether, 95°; carbon bisulphide, 117°; chloroform, 142°. The vapors of most of these are violently explosive, and must be handled with the utmost caution in the presence of fire. The vapor of hydrofluoric acid is extremely corrosive and cannot be allowed to escape into the air in the room where any one is; nor can it be held in glass receptacles, since it consumes glass with readiness.

(8011) I. S. W. asks: How can I make a simple sal ammoniac cell? A. A stick of zinc, a plate of carbon, and a saturated solution of sal ammoniac in a glass cell are the materials for a simple cell. The carbon should have many times as much surface as the zinc. The zinc is usually a rod of about ⅜ inch in diameter.

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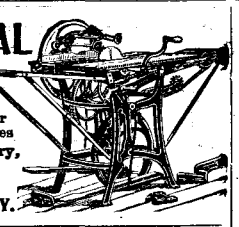

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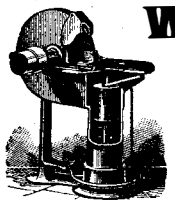

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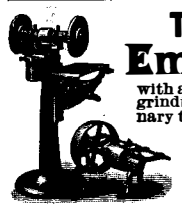

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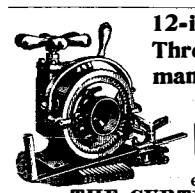

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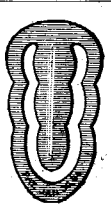

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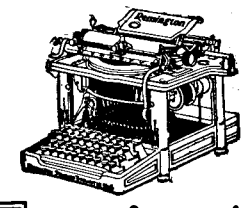

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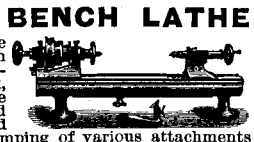

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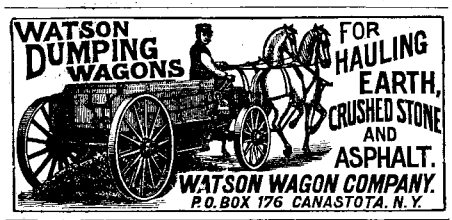

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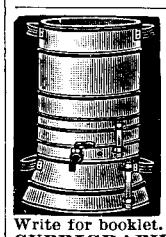

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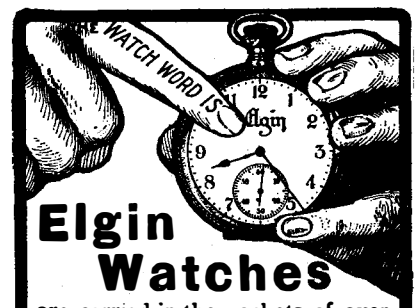

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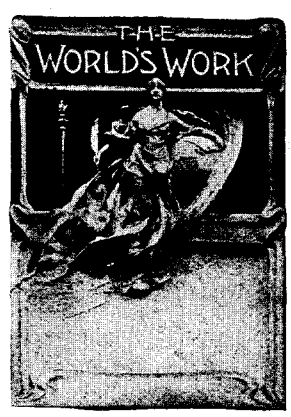

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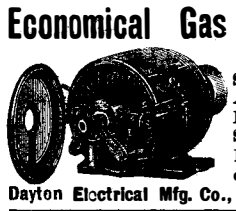

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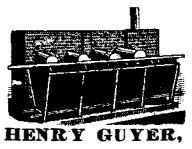

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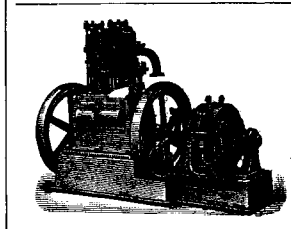

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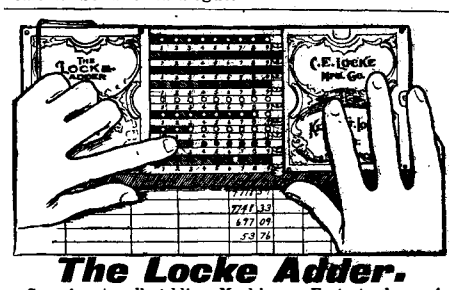

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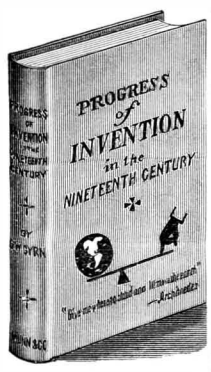

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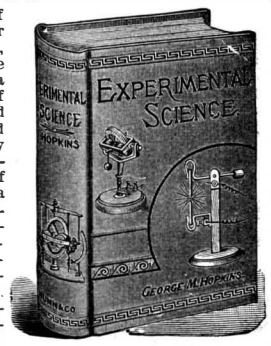

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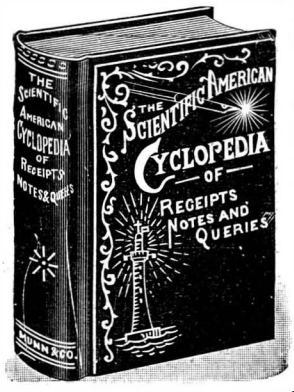

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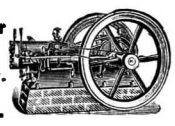

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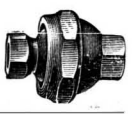

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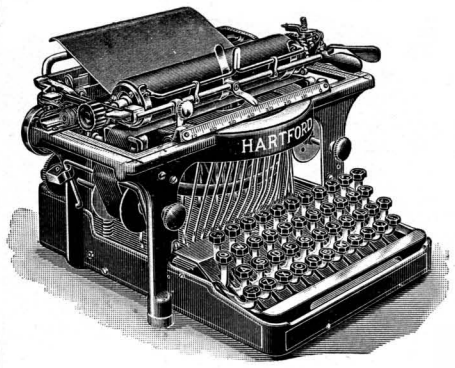

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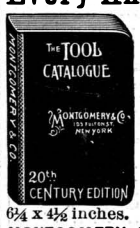

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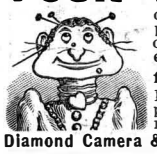

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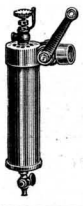

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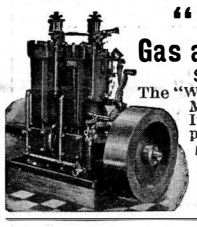

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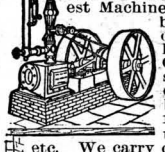

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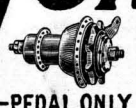

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